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A. C. TRUE, Director.

A SECONDARY COURSE IN ANIMAL PRODUCTION.

BY

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Office of Experiment Stations,
Washington, D. C., August 19, 1910.

Sir: I have the honor to transmit herewith a report on secondary instruction in animal production, by Prof. H. R. Smith, of the University of Nebraska. This report is the thirteenth prepared under the direction of the Committee on Instruction in Agriculture of the Association of American Agricultural Colleges and Experiment Stations, and is recommended for publication as Circular 100 of this Office.

Respectfully,

A. C. True,
Director.

Hon. James Wilson,
Secretary of Agriculture.

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A SECONDARY COURSE IN ANIMAL PRODUCTION.

INTRODUCTION.

This is the third of a series of reports on agriculture in the public high schools.[a] The first of these reports[b] gave a number of tentative schedules for public high schools to show the place of agriculture in such courses; the second report,[c] entitled "A Secondary Course in Agronomy," gave a syllabus of lectures, recitations, and practicums suitable for the first year of a two-year course in agriculture for public high schools. This report contains outlines of lectures, recitations, and practicums in animal production and dairying suitable for the second year of a two-year course in agriculture for public high schools.

As explained in the introductory paragraphs of the eleventh report of the committee, A Secondary Course in Agronomy, the term agriculture as applied to courses of instruction should be used to include in a comprehensive way the science and practice of the production of plants and animals useful to man and the uses of such plants and animals as far as these are closely connected with their production. The divisions of agriculture, as given by the committee in its various reports and as defined in its eleventh report, include (1) plant production, (2) animal production or zootechny, (3) agrotechny or agricultural technology, (4) rural engineering, and (5) rural economics.

These divisions, for the purposes of high school instruction, have been placed by the committee in two groups: Group I, agronomy, agricultural engineering, and agricultural economics, to occupy preferably the third year in a four-year high school course; and Group II, animal production, and dairying, to occupy the fourth year. This report covers the subjects in Group II.

GENERAL SUGGESTIONS TO TEACHERS.

In this syllabus on animal production there are 155 lessons which, with necessary reviews, examinations, and a few supplementary field trips or lessons of a purely local nature, will occupy a full school year

[a] Thirteenth Report of the Committee on Instruction in Agriculture of the Association of American Agricultural Colleges and Experiment Stations.

[b] Seventh Report of the Committee on Methods of Teaching Agriculture, U. S. Dept. Agr., Office of Experiment Stations Circ. 49.

[c] Eleventh Report of the Committee on Instruction in Agriculture, U. S. Dept. Agr., Office of Experiment Stations Circ. 77.

of thirty-six weeks, five recitations a week. If, however, a full year is not available for this branch of agriculture, the course can be shortened by omitting certain of the less important lessons or by studying only the most general facts relating to animals having small commercial value in the locality. Thus, for example, there are many localities where the two lessons on ponies, asses, and mules could be omitted because these animals are there so seldom seen or used as to be of no economic importance. Again, there are regions where cattle raising runs almost entirely to one type—either the beef type or the dairy type. In such places the emphasis should be placed on the important type of cattle and only such time as can be spared should be given to the less important types. The same considerations should govern the study of sheep, swine, poultry, and other animals or topics included in this outline.

The exercises are so arranged that every fifth lesson is a practicum. This has been done, in some cases at a sacrifice of logical arrangement, to enable the teacher better to arrange the weekly program than would be possible with practicums coming at irregular intervals. It will usually be found most convenient to designate the last day of each week as practicum day, and there would also be some advantage in having the work in agriculture occupy the last recitation period in the day, so that on field trips occupying more than the allotted time for regular class periods the necessary extra time can be taken without interfering with other recitations.

It is not expected that the exercises will take the place of text-books and works of reference. They are intended simply as a guide for the teacher in giving instruction. While many facts are presented in skeleton form, the books and bulletins referred to in each exercise are to be the chief sources of information for teacher and student. It is expected that the instructor will use his own judgment as to the amount of reading the students are capable of doing. Every reference bears directly upon the question under consideration and in most of the exercises the student will be able to study all references except those preceded by (T), which are rather technical and intended only for the teacher, who is to use what he can of the information to supplement the text to be recited upon.

The library of the school should be supplied with (1) several farm journals; (2) bulletins of the United States Department of Agriculture dealing with animal production, which can be secured from the Secretary of Agriculture, Members of Congress, or the Superintendent of Documents, Washington, D. C.; (3) all bulletins of the state agricultural experiment station on farm animals; and (4) a considerable number of text-books and manuals, including all that can be procured of the books to which specific references are given on the following pages. A list of these books is given on page 55.

A limited amount of apparatus will be necessary for the laboratory work in dairying. This will cost from $90 to $105 if all of it is purchased. Sometimes it is possible to secure the loan of one or more cream separators from dealers wishing to advertise them. A list of the necessary apparatus is given on page 56.

SYLLABUS OF LECTURES, RECITATIONS, AND PRACTICUMS FOR SECONDARY INSTRUCTION IN ANIMAL PRODUCTION.

TYPES AND BREEDS OF FARM ANIMALS.

1 LECTURE. Animal husbandry as correlated with crop growing.

Impress upon the minds of the pupils the importance of keeping live stock on the farm, emphasizing the fact that while farm animals are kept primarily to supply the demand for meat, milk products, and eggs for human consumption, wool and mohair for clothing, and to furnish motive power for certain kinds of labor, it is also true that only by keeping animals on the farm is there made possible a maximum production of grain year after year, and a complete utilization of everything grown on the farm, including the so-called by-products of grain production.

As it costs no more to plow and till rich ground than that which has been allowed to deteriorate by continuous grain growing, it is apparent that any added yield is almost clear profit. In 1 ton of corn (35.7 bushels) harvested from 1 acre there is removed from the soil 11.8 pounds of phosphoric acid, 7.4 pounds of potash, and 5.6 pounds of nitrogen, which would cost in the form of commercial fertilizers approximately $6.75. The proportion that could be returned in the form of barnyard manure varies with the different classes of farm stock, younger animals of a given class returning a smaller percentage than older ones, but with such animals as are found on the average farm approximately 85 per cent of the fertilizing value of the corn could be put back into the soil. Furthermore, a rational system of stock raising calls for the growing of leguminous feedstuffs—clover, alfalfa, or cowpeas—which in an approved rotation of crops draw from the air more nitrogen than is sold from the land in the form of meat and other animal products. The loss of potash and phosphoric acid in animal products is very slight, and most soils have an abundance in reserve. The presence of humus is very desirable, and soils are also improved physically by the intelligent application of barnyard manure, a part of which is straw and other refuse which would be much less effective if plowed under unmixed with animal excrement.

Call attention also to the fact that farm animals furnish a home market for our grains, thus saving the haul to the local elevator.

They reduce the freight charges approximately 80 per cent, because the product is condensed to that extent, and on hay a still larger percentage because of its greater bulk. They furnish a market for such by-products as oat straw and cornstalks, coarse material which would otherwise not be utilized as food. Help on the farm may be had at a lower monthly wage for the year if work is furnished in winter caring for stock as well as during the summer months. More interest and enjoyment is given to country life by having animals, as they appeal to the esthetic nature of a normal person, good animals more so than inferior ones.

Having shown that the keeping of domestic animals is an important part of good farming, giving to our agriculture some degree of permanency, next point out the fact that each landowner should keep more of that class of animals which is best adapted to local conditions, giving consideration to the character of the land, its geographical location, markets, etc., and yet he should have some of each class of animals—horses for work, cattle for beef or for milk, sheep for mutton, wool, and incidentally to eradicate weeds, swine for pork, poultry for meat and eggs, and incidentally both of the last-named classes of scavengers to prevent waste from the kitchen, about the feed lots, and elsewhere. Not only has each of these classes its particular sphere of usefulness, but our modern domestic animals, in their high state of development as directed by man, show a divergence of type within a given class, each type best adapted for that particular thing for which it is intended; for example, some horses for great power and little speed and others for great speed and little power; again, some cattle for giving great quantities of milk and inferior beef, while others are bred for producing thick carcasses of finely marbled meat, but little milk.

Aside from the beneficial effect upon the land already noted, animal production is most profitable (1) when care is exercised in the selection of those types which serve a particular purpose to the best advantage, and (2) when such animals are cared for—fed and sheltered—in a manner that will give the largest returns for the least expenditure. In these exercises the animal will be considered first, then its care and feeding. (Profitable Stock Feeding,[a] pp. 3–6; Elements of Agriculture, pp. 135–147; U. S. Dept. Agr., Bur. Statis. Bul. 78; U. S. Dept. Agr., Farmers' Bul. 192.)

HORSES.

2 Recitation. The prehistoric horse.

The pupils should read an account of the earliest form of the horse (Eohippus), as revealed by recent geological investigations, and

[a] For more specific references to all books mentioned in these lessons, see page 55.

note the gradual modification of this type due to changes in the earth's physiography and climate during successive geological ages. The evolution of the horse from the earliest known form studied with some minuteness will give the pupil a fair conception of how animal life is modified through natural agencies. (The Prehistoric Horse, Century Mag., November, 1904; The Horse Book, pp. 7–12; Types and Breeds of Farm Animals, pp. 1–6; Domesticated Animals and Plants, pp. 211–215.)

3 Recitation. The primitive wild horse and related species.

The horse (*Equus caballus*) as related to the zebra, ass, and other species of the genus Equus. The zebra, wild ass, and cave horse are supposed to be connecting links between the prehistoric and modern horse. The pupils should describe the different types of wild horses found in Europe and Asia, giving the habits and characteristics of each. (Horses, Asses, Zebras, Mules, and Mule Breeding, pp. 1–64; A Sketch of the Development of the Modern Horse, pp. 5–12; Variation of Animals and Plants Under Domestication, Vol. 1, pp. 51–67; Domesticated Animals and Plants, pp. 211–218.)

4 Recitation. The Arabian horse.

What is the supposed origin of the Arabian horse? The Arabs were the first people to keep pedigrees and to make a practical application of some of the laws of breeding. By what methods did they bring their horses to such a high state of perfection in early times? The influence of the Arabian horse in the improvement of our present-day breeds should be emphasized. (Gleanings from the Desert of Arabia; Types and Breeds of Farm Animals, pp. 7–13.)

5 Practicum. Comparison of types of horses and judging roadsters.

Arrange to have horses brought to the school or take the class to some near-by farm where there can be brought together three horses, one to represent the draft type—a Percheron, Shire, Clydesdale, or Belgian; one the coach or general-purpose type—a French Coach, German Coach, Hackney, or Cleveland Bay; and a third to represent the roadster type—a standard-bred trotter, pacer, or saddler. Stand these three types side by side and point out to the class the differences in conformation, showing why the roadster is best adapted for great speed, the draft type for power, and the coach or general-purpose horse for both to a medium degree. Show each horse in action and note differences in the use of limbs.

Select two roadsters of nearly the same size, but one of them superior to the other in most points. Have the class score both together, the instructor explaining the scale of points as the scoring proceeds. After each pupil's marks are totaled, which gives his estimate as to the superiority of one horse over the other, the corrected score as given by the instructor may be recorded, explanations being

made frequently. In the early work with the card an accurate score of each animal should not be expected. However, by comparing the two horses in every detail it will be possible to determine which is the better individual and wherein one is superior to the other. Skill in judging is largely a matter of well-directed practice. Much more rapid progress will be made when two or three animals are scored together than if they were to be scored separately. The beginner does not have a clear conception of the ideal conformation, but he will be able to detect differences when comparisons are made. Examine horses for soundness. (See scale of points for light horses, U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61, p. 13; or Judging Live Stock, scale of points, p. 31; soundness, p. 52.) Have cards or tablets printed, making provision for three horses instead of one, as indicated in the references. (Judging Live Stock, pp. 5–44; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 37.)

6 Recitation. The English Thoroughbred and the American saddle horse.

The origin of the English Thoroughbred is a matter of considerable interest because of the influence of this breed in the establishment of the American trotter and the saddle horse. The latter was developed as such in Kentucky and surrounding States. The characteristics of the English and American Thoroughbreds and of the American saddle horses should be given considerable attention. (The Origin and Influence of the Thoroughbred; A Sketch of the Development of the Modern Horse; The Horse, pp. 61–70, 86–95.)

7 Recitation. The trotter and pacer.

The pupils should trace the development of horse racing in America, the origin of the trotter, the leading families—Hambletonian, Mambrino, Morgan, Clay, etc.—and the records of famous trotters and pacers. (Light Horses: Breeds and Management; The Horse, pp. 70–86; Types and Breeds of Farm Animals, pp. 36–58.)

8 Recitation. Coach or carriage breeds—Hackney.

Discuss the coach type and have the pupils study the origin, development, characteristics, and adaptation of the Hackney horse. (Types and Breeds of Farm Animals, pp. 58–72.)

9 Recitation. Other coach breeds.

Have the pupils make a study of French Coach, German Coach, and the Cleveland Bay, as described in previous lesson, and compare these four carriage breeds. (Types and Breeds of Farm Animals, pp. 72–92.)

10 Practicum. Judging coach horses.

If available, procure two horses of one of the four coach breeds mentioned above, and score as directed for light horses. Score also

a pair of another coach breed if possible. If coach horses are not available, select three roadsters for further practice work with that type.

11 Recitation. Draft breeds—Percheron and Belgian.

The development of the Percheron horse under the skillful management of the Frenchman should be treated at some length; also the characteristics of the breed as to color, weight, etc., and the effect of their introduction into America. Treat the Belgian in the same manner, but less fully. (The Percheron Horse; Types and Breeds of Farm Animals, pp. 92, 133; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 37.)

12 Recitation. Shire and Clydesdale.

Describe the conditions under which the Shire was developed in England and the Clydesdale in Scotland. Compare the characteristics of each breed as they exist to-day. The Shires and Clydesdales are also being imported into America in large numbers each year, where they are exerting a marked influence for the betterment of draft horses. (The Great Horse; Types and Breeds of Farm Animals, pp. 114–132.)

13 Recitation. Ponies.

Describe the characteristics of Shetland, Welsh, and Indian ponies, and the western bronchos, and the conditions under which they were produced. Make it clear that ponies are dwarfed horses, reduced in size because of scanty vegetation in their native countries, and that these ponies when imported to America invariably become larger during successive generations because of improved conditions. (Types and Breeds of Farm Animals, pp. 146–154.)

14 Recitation. The ass and the mule.

One species of wild ass is native of Africa, another of Asia. Describe the domestic ass as found in America to-day; also the hybrid known as the mule. Show why the mule is superior to the horse for certain kinds of work. In what States are mules most numerous? (Horses, Asses, Zebras, Mules, and Mule Breeding; Types and Breeds of Farm Animals, pp. 155–166; U. S. Dept. Agr., Bur. Statis., Crop Reporter, Feb., 1910.)

15 Practicum. Judging draft horses.

Procure two specimens of one or more of the four draft breeds and have pupils score as directed for light horses, using scale of points as shown in Judging Live Stock, p. 43, or U. S. Dept. Agr., Bur. Anim. Indus. Bul. 37, p. 26.

16 Recitation. Grooming, clipping, and training horses.

Emphasize the fact that careful and thorough grooming keeps open the pores of the skin and stimulates the secretions, thus contributing

much toward keeping the animal in a healthy condition. Grooming also improves the appearance of the horse. Clipping is to be recommended for some horses if care is taken to use blankets when the weather becomes suddenly cold, as it often does in early spring. The future usefulness of the horse depends much upon its early training, which should be thoroughly discussed. (The Care of Animals, pp. 21–26, 74–87.)

17 Recitation. Drenches, blisters, fomentations, antiseptics, etc.

Horses are more likely to be injured than are other farm animals, and the student should know when to use such simple remedies as blisters, fomentations, etc., and how to use them to the best advantage. (The Care of Animals, pp. 128–155; Special Report on Diseases of the Horse, U. S. Dept. Agr., Bur. Anim. Indus., 1907, rev. ed., pp. 459–481.[a])

18 Recitation. Anatomy of horse's foot, shoeing, and treatment of nail wounds.

The importance of good feet well cared for is so great that one period should be devoted to this subject. (U. S. Dept. Agr., Farmers' Buls. 179; 259, p. 30; Special Report on Diseases of the Horse, pp. 559–581.)

19 Recitation. Bone diseases.

Discuss briefly the more common bone diseases of the horse, such as spavins, ringbones, puffs, splints, etc. (The Care of Animals, pp. 217–243; Special Report on Diseases of the Horse, pp. 274–368.)

20 Practicum. Procure three draft horses and score as previously directed. Give attention also to bone diseases in going over the horses.

21 Recitation. Indications of disease and general treatment.

Discuss the pulse, temperature, and respiration of the horse, and the use of bandages and slings. Proper food is important in treating diseases. (The Care of Animals, pp. 108–127; Special Report on Diseases of the Horse, pp. 9–33.)

22 Recitation. Stomach and intestinal difficulties.

Make it clear that with good feeding the cases of indigestion will be rare. Some horses are much more subject to them than others. Prompt treatment at home will cause most cases to respond quickly. (The Care of Animals, p. 258 and pp. 263–275; Special Report on Diseases of the Horse, pp. 34–74.)

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[a] This publication can be secured free only from Members of Congress. It can be purchased from the Superintendent of Documents, Washington, D. C., for 65 cents.

23 LECTURE. Cattle—zoological classification.

Cattle belong to the class Mammalia, order Ruminantia, and genus Bos. The order Ruminantia—animals which ruminate or chew the cud—also includes the camel, deer, giraffe, antelope, goat, sheep, musk-ox, and llama. The American bison (*Bos americanus*), commonly called "buffalo," and the European bison (*Bos bison*) belong to the same genus as the humped cattle of India (*Bos indicus*) and our common domesticated cattle (*Bos taurus*). It would be well to tell the students something about the American bison, which once inhabited our plains, and how it has been almost completely exterminated, the only remaining specimens being kept in parks. (The Natural History of Bulls, Bisons, and Buffaloes; Domesticated Animals and Plants, pp. 219–227.)

24 LECTURE. Development of modern types and breeds.

Accurate information concerning the progenitors of our domestic cattle is meager, but they are supposed to have come from wild forms. The wild white cattle of Great Britain, specimens of which are now kept in Chillingham, Hamilton, and Chartley parks, are credited with having had much influence on the formation of our domestic types of cattle. It would be well for the students to have some knowledge of the habits and characteristics of these cattle.

All cattle may be said to be of two general classes, improved and unimproved. The former have been successfully bred for a purpose, while the latter have not. They have therefore no particular adaptation and are often called "scrubs." An example of the first class would be any of our pure breeds and high grades, while examples of the latter would be found in the Texas steer and southern mongrels, both of which are of Spanish descent.

All modern breeds of cattle may be put into three general groups or types. The breeds of one group—Shorthorn, Polled Durham, Hereford, Aberdeen Angus, and Galloway—have been bred primarily for the production of beef of the best quality. Another group, which includes the Holstein-Friesian, Jersey, Guernsey, and Ayrshire, has been bred primarily for milk and secondarily for beef. The third group, less clearly defined, is supposed to be a compromise, as it were, in which the production of both beef and milk have been given equal consideration by the men who have been breeding them. The breeds in this group may be said to possess both tendencies in a moderate degree, but neither to the extreme, as the two functions are quite incompatible when an attempt is made to develop both together to an abnormal degree. This group, called the "dual-purpose type," includes the Red Polls, Devons, Brown Swiss, and certain families of Shorthorns and Polled Durhams. (The New Elementary Agri-

culture, pp. 166–171; Elements of Agriculture, pp. 323–333; The Study of Breeds in America, pp. 1–9; Farm Live Stock of Great Britain; The Wild White Cattle of Great Britain; Variation of Animals and Plants under Domestication, pp. 82–97.)

25 Practicum. Comparison of types of cattle.

Procure a good specimen of a well-fleshed beef cow—Shorthorn, Hereford, Angus, or Galloway; a choice dairy type—Holstein, Jersey, Guernsey, or Ayrshire; and, if available, a dual-purpose type—Red Poll, Brown Swiss, Devon, or a heavy milking Shorthorn. Stand these three specimens side by side and point out the differences in the conformation of the beef and dairy type, referring also to the intermediate type if such may be had. Note first of all the general form, box-like in the case of the beef type and wedge-shaped in the dairy type. Then begin with the head and compare the conformation of each in detail. Get from your local meat dealer the retail price of the various cuts of beef in the carcass; mark out on the beef cow, by means of a piece of blue carpenter's chalk, the location of these various cuts as per diagram in references below, indicating price in each section marked off. This will give the students a graphic illustration showing why broad backs and full hind quarters, etc., are desirable in the beef animal. (Types and Breeds of Farm Animals, pp. 169–174, 243–248; The Study of Breeds in America, pp. 10–22; Judging Live Stock, pp. 60–90.)

If a near-by farmer is feeding steers for market, it would also be well to take the class to his feed lot to inspect them. Note individual differences. They may have been fed alike, but some individuals are more beefy in conformation, much broader over the back and hind quarters. Others are narrow throughout, rangy in build, and poorly fleshed. Have the class point out the best specimens of the herd and also some of the most inferior ones. Usually the better individuals are from good ancestry; that is, have been more highly improved by methods of breeding. (Profitable Stock Feeding, pp. 113–141; Judging Live Stock, pp. 60–72; Illinois Sta. Bul. 78.)

26 Recitation. Shorthorns.

A careful review of the development of the breed known as Shorthorns will give the student a fair idea of what methods have been successfully employed in breeding up cattle. They were originally called "Durham" because first known as a breed in Durham County, England, and the surrounding territory. Point out on the map the location of this county. The work of early breeders of note—Bates, Booth, and Cruickshank—should be emphasized. Compare early types of Shorthorns with the modern as we have them in America to-day. Their leading characteristics should be described. There is a greater variation in Shorthorn type than is found within any

other single breed. Some are very beefy, while there are other specimens of pure-bred Shorthorns that are good milkers, the latter tracing back to Bates breeding. While studying the Shorthorns, have the students learn something about the breed organizations and methods of recording animals and keeping pedigrees. (Shorthorn Cattle; Types and Breeds of Farm Animals, pp. 175–196; The Study of Breeds in America, pp. 23–36; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 34; U. S. Dept. Agr., Farmers' Bul. 106, p. 41.)

27 Recitation. Polled Durhams and Herefords.

Show that the Polled Durhams are Shorthorns without horns, the same having been bred off by Americans because of the fact that a higher price is paid for hornless feeding steers. Polled cattle feed more quietly and ship better than horned cattle. Practically all Polled Durhams are now double-standard; that is, eligible to registration in both the Shorthorn and Polled Durham associations. Touch very briefly upon the history of Hereford cattle. Bring out their leading characteristics. The Herefords make their best beef at an early age. They are popular in the western range districts because they are persistent grazers and seem better able to withstand the hardships of winter than some other breeds. (Types and Breeds of Farm Animals, pp. 197–212; The Study of Breeds in America, pp. 37–48; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 34; U. S. Dept. Agr., Farmers' Bul. 106, p. 35.)

28 Recitation. Aberdeen Angus and Galloways.

Give historical sketch of these two breeds, both of which are of Scotch origin, the Aberdeen Angus coming originally from the counties of Aberdeen and Forfar (formerly called Angus), and the Galloways from that district in the south of Scotland called Galloway. While both breeds are supposed to have come from the same original stock, the environment of one has been very different from that of the other, the Galloways having been subjected to the rigors of a cold, damp climate such as prevails in the Highlands of Scotland where the vegetation is also scanty. The Angus have been more or less confined to the lowlands, where the weather is less severe and where food is more abundant, large quantities of roots being supplied. Because of their early environment Galloways feed better than Angus under unfavorable conditions—scanty food supply and severe weather—while Angus cattle fatten much more rapidly under favorable conditions, such as prevail in the grain-growing district of the United States. Compare also these two breeds with the Shorthorns and Herefords. (Types and Breeds of Farm Animals, pp. 213–233; The Study of Breeds in America, pp. 49–71; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 34.)

29 Recitation. Dual purpose breeds—Red Polls, Devons, and Brown Swiss.

In studying these three breeds, give the greatest emphasis to the breed which is most common in your locality. Red Polls are found quite generally distributed throughout the United States. Devons are confined almost entirely to States in the East and Southeast near the Atlantic coast. Brown Swiss have only been introduced into the United States during recent years. They are used for draft purposes in Switzerland, and therefore might properly be called triple-purpose cattle—beef, milk, and work. The heavy shoulder of the Brown Swiss, indicating strength, is objectionable in America, where only beef and milk are sought in cattle. Note milk records of individuals of this breed. (Types and Breeds of Farm Animals, pp. 309–331; The Study of Breeds in America, pp. 151–172; U. S. Dept. Agr., Farmers' Bul. 106, pp. 11–18, 38–41; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 75, p. 165.)

30 Practicum. Judging the beef breeds.

Procure two specimens of pure-bred Shorthorn cows or bulls, of the same size or nearly so, quiet in disposition and well broken to lead. Have students score by comparison as directed for horses, using scale of points as published in Judging Live Stock, p. 72; or U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61, p. 43. Have the scale of points printed on cards or tablets in sufficient quantity to meet the needs of the class for the entire year or longer, and make provision for scoring three animals on one card. While, in this early judging of beef cattle, the students will doubtless give a very imperfect score, their relative markings should at least show which is the better individual of the two, which is all that can be expected at the beginning.

Procure also, if possible, three specimens of Hereford, Angus, or Galloway cows or bulls and score by comparison, using the same scale of points as directed for Shorthorns. In judging bulls of any of the improved breeds, emphasize the importance of masculinity as indicated by the broad head covered with curly hair, thick, well-developed crest of the neck, and heavy shoulders. Breeding sires which possess this masculine appearance are much more certain to transmit their qualities to offspring. The cows, on the contrary, should have the marked feminine appearance indicated by refinement of the head, neck, and shoulders. Cows possessing feminine character ordinarily make better mothers. (See also Aberdeen Angus scale of points, U. S. Dept. Agr., Bur. Anim. Indus. Bul. 76, pp. 11, 12; or score cards used in judging Shorthorns and Herefords may be used by calling attention to breed differences.)

31 Recitation. Dairy breeds—Jersey.

Describe thoroughly the proper conformation of the dairy cow before taking up the breeds. Point out the location of the islands in the English Channel from which the Jersey and Guernsey derive their names. Describe the size of these islands, their chief resources, and the people inhabiting them. By what methods did they develop such highly specialized butter-producing cattle? Give leading characteristics of the Jersey as to size, color markings, etc., and their distribution in America. Call attention to the butter records of a few of the best known Jerseys in America. (Types and Breeds of Farm Animals, pp. 241–263; The Study of Breeds in America, pp. 123–132; U. S. Dept. Agr., Farmers' Bul. 106, pp. 20–23, 29–35; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 75.)

32 Recitation. Dairy breeds (continued)—Guernsey.

Complete the study of Jerseys, and study in the same manner the characteristics of the Guernseys, referring to some of the best butter records made by individuals of this breed. (Types and Breeds of Farm Animals, pp. 276–286; The Study of Breeds in America, pp. 113–123; U. S. Dept. Agr., Farmers' Bul. 106; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 75.)

33 Recitation. Dairy breeds (continued)—Holstein-Friesian.

Discuss what is known concerning the origin of Holstein cattle, their care and management in Holland, and the leading characteristics of the breed. Holsteins give a much larger quantity of milk than do Jerseys or Guernseys, but it is relatively low in butter fat. (Types and Breeds of Farm Animals, pp. 264–275; The Study of Breeds in America, pp. 85–94; U. S. Dept. Agr., Farmers' Bul. 106; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 75.)

34 Recitation. Dairy breeds (continued)—Ayrshire.

The Ayrshire is supposed to be an admixture of several breeds of cattle native of the county of Ayr, Scotland. Study their characteristics. Note milk records of individuals of this breed. (The Study of Breeds in America, pp. 101–108; Types and Breeds of Farm Animals, pp. 287–295; U. S. Dept. Agr., Farmers' Bul. 106; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 75.)

35 Practicum. Judging dairy cows.

Select two Jersey or two Guernsey cows and score by comparison as previously directed, using scale of points as found in Judging Live Stock, pages 76–90, 97–101. (U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61, pp. et seq.)

Procure also three Holstein or Ayrshire cows and score by comparison. (The Study of Breeds in America, pp. 92–93, 109–111; Judging Live Stock, pp. 95–96, 103–104.)

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36 Recitation. Diseases of cattle—Milk fever.

This is a disease frequently encountered by dairymen which may give much trouble, but is quick to respond to treatment of the right kind. Discuss causes, prevention, and treatment. (The Care of Animals, pp. 374–376; U. S. Dept. Agr., Farmers' Buls. 206, pp. 15; 259, pp. 28–30.)

37 Recitation. Tuberculosis.

This disease is very prevalent throughout the country, and seems difficult to cope with. However, it will be stamped out when once understood and when proper laws are enacted to combat it. The pupils should be familiar with its causes, how it spreads in a herd, and how to apply the tuberculin test to detect it. (The Farm Dairy, pp. 42–45; The Care of Animals, pp. 378–384; U. S. Dept. Agr., Yearbook Separate 15, 1894, pp. 317–330; Elements of Agriculture, pp. 337–340.)

38 Recitation. Impaction of the rumen.

Digestive disorders caused by overeating are of frequent occurrence among cattle, and it would be well to give one period to the discussion of the stomach of ruminants and difficulties due to impaction. (The Care of Animals, Special Report on Diseases of Cattle, U. S. Dept. Agr., Bur. Anim. Indus., 1908, rev. ed., pp. 14–52.[a])

SHEEP AND GOATS.

39 Lecture. Sheep—Zoological classification and origin of domestic breeds.

Class Mammalia, order Ruminantia, and genus Ovis. There are said to be 21 wild species, native of Europe, Asia, Africa, and America. The wild form in America is known as the Rocky Mountain sheep. All wild sheep naturally take to a mountainous district. Sheep have been domesticated for a great many years. There are numerous references to them in the Bible. Sheep have been improved to a greater degree in Great Britain than in any other country. It would be well to give the students a talk on the introduction of sheep into the United States, as found in a very comprehensive treatise entitled Special Report of the Sheep Industry of the United States (U. S. Dept. Agr., Bur. Anim. Indus., 1892). (The Study of Breeds in America, pp. 173–178; Variation of Animals and Plants under Domestication, pp. 97–106; Domesticated Animals and Plants, pp. 227–231.)

40 Practicum. Types of sheep and the classification of modern breeds.

Improved breeds are usually classed with respect to wool as fine-wooled, medium-wooled, and coarse-wooled. A more logical classi-

[a] May be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, $1.

fication, one having to do with general utility, would be wool breeds and mutton breeds, the first group to include the American Merino, the Delaine Merino, and the Rambouillet (French Merino), breeds adapted primarily for the production of wool and secondarily for mutton. The second group, adapted primarily for mutton and secondarily for wool, would include the so-called "long-wooled" breeds—Leicester, Lincoln, and Cotswold; and also the Down breeds—Southdown, Shropshire, Hampshire, Oxford, Dorset Horned, and Cheviot. Procure a good specimen of one of the three Merinos mentioned and also one of the mutton breeds. A greater contrast will be found if an American Merino is used, as the Delaine Merino and Rambouillet possess more of the mutton qualities. Procure specimens of each type and point out differences in form, size, fleece, etc. Score together one or more pairs of Merinos. (Types and Breeds of Farm Animals, pp. 333–338, 375–377; The Study of Breeds in America, pp. 178–182; Judging Live Stock, pp. 114–117, 125; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61, pp. 112–113.)

41 Recitation. The Spanish Merino and the American Merino.

Have the students learn what is known concerning the Merino as found in Spain and modified by American breeders. Give a talk or assign readings on wool, its preparation and uses. (The Study of Breeds in America, pp. 183–190; Types and Breeds of Farm Animals, pp. 336–356; Judging Live Stock, pp. 117–124.)

42 Recitation. Delaine Merino and Rambouillet.

What are Delaine woolens? Delaine Merinos are a modification of the American Merino in which size has been increased and mutton qualities improved. Rambouillet is the name of a village in France, near which Merinos from Spain were greatly improved both in mutton and wool. Give characteristics and compare these breeds with each other and also with the American Merino. The distribution of each breed in America should also be considered. (The Study of Breeds in America, pp. 192–204; Types and Breeds of Farm Animals, pp. 357–374; Sheep Farming in America, pp. 21–31.)

43 Recitation. Market classes of mutton sheep.

Before taking up the different breeds of mutton sheep have students learn something about market demands and how sheep are classed when sold at the market places. (U. S. Dept. Agr., Farmers' Buls. 96, pp. 3–6; 184, pp. 20, 27; 360, pp. 17–29.)

44 Recitation. Long-wooled breeds—Leicester, Lincoln, and Cotswold.

These three breeds are of English origin. Point out on the map the location of each district from which they come. Describe the soil and climate of England. Discuss with the class the great work of

Robert Bakewell as an improver of Leicester sheep and the influence of this breed in improving the mutton qualities of other breeds. The students should have a clear understanding of the characteristics of each of these breeds and the reasons for their popularity in America. (Types and Breeds of Farm Animals, pp. 429–449; The Study of Breeds in America, pp. 257–275.)

45 Practicum. Judging Lincolns, Leicesters, or Cotswolds.

Select several pairs of ewes, wethers, or rams of any of these breeds and score by comparison, using scale of points as published in The Study of Breeds in America, pp. 267, 274; Judging Live Stock, p. 126; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61, pp. 97–111. There should be one pair for a group of four students, two scoring while the other two are holding the sheep.

46 Recitation. Southdowns and Shropshires.

Discuss the native home of the Southdowns, their size, adaptability, and other characteristics. The Shropshire is supposed to contain the blood of Southdown, Leicester, and Cotswold. This is a very popular breed in America. Neither the Southdowns nor the Shropshires are as large as the long-wooled breeds, but they are now in greater favor in the market. Describe the characteristics of the Shropshire. (Types and Breeds of Farm Animals, pp. 378–394; The study of Breeds in America, pp. 206–209, 225–228; Sheep Farming in America, pp. 32–40.)

47 Recitation. Hampshires and Oxfords.

Point out the location of Hampshire County in south-central England. Explain that Southdown blood was used in the improvement of the Hampshire. This breed is rapidly growing in favor in America for the production of early lambs. Hampshire rams are especially good for crossing on Merino ewes for the production of market lambs. The Oxford came originally from Oxford County, England, and are somewhat larger than the Hampshires, but less popular in America. Compare these two breeds in leading characteristics and also with the Southdown and Shropshire. (Types and Breeds of Farm Animals, pp. 395–407; The Study of Breeds in America, pp. 243–255.)

48 Recitation. Dorset Horned and Cheviot sheep.

Dorsets come originally from the county in southern England bearing that name. This is the only breed of English origin possessing horns. The ewes are very heavy milkers and very prolific. The lambs attain unusual size at an early age because they are so well nourished. Cheviots come from the Cheviot Hills on the border between England and Scotland. Refer to a map of Great Britain. They are usually good grazers and very rugged, owing to the fact that they have been subjected to adverse conditions which prevail in

this sparsely covered hill district. Point out the leading characteristics of each of these two breeds.

49 Recitation. Angora and milk goats.

The Angora goat industry is becoming of considerable importance in certain sections of the United States, particularly where underbrush covers the ground which it is desired to clear. These goats are not only useful as browsers, but the mohair is very valuable and the meat edible. It will be well to devote at least one period to the study of goats. The milk goat is extensively used in some countries for supplying milk for family use, and has already been introduced into the United States. (Types and Breeds of Farm Animals, pp. 455–465; U. S. Dept. Agr., Bur. Anim. Indus. Buls. 27, 68.[a])

50 Practicum. Judging the medium-wooled breeds.

Score by comparison a few specimens of one or more of these breeds. Use scale of points as directed in Exercise 45, scoring in groups of twos and threes as before.

51 Recitation. Washing, shearing, and marketing.

The revenue from wool is no small part of the profits from sheep raising and some attention should be given to this product. (Sheep Farming in America, pp. 164–179; Feeds and Feeding, pp. 512–513.)

52 Recitation. Parasites and diseases.

In the farming districts internal parasites very commonly do much injury to flocks of ewes. Lambs seldom show the effect of these parasites until after weaned from the ewe, when they frequently grow thin, even when liberally fed. (Sheep Farming in America, pp. 277–307; The Care of Animals, pp. 334–339, 340–350.)

SWINE.

53 Lecture. Swine—zoological classification and origin of domestic breeds.

Swine belong to the family Suidae and genus Sus. The domestic hog is supposed to have been developed from the wild boar, native of Europe, Asia, and North Africa. It is supposed also that another species, known as *Sus indicus*, from China and Siam, has had much influence on the formation of our modern breeds. The wild boar (*Sus scrofa*) still exists in the wild state in central Europe and in Asia. It is long in limb, very muscular, and fleet of foot. The species *Sus indicus* is not known in the wild form. It is supposed to have been domesticated in the Orient at a very early date.

The first class period on the subject of swine could be well spent in giving a description of the habits of the wild boar and also what is

[a] The Department's supply of Bul. 68 is exhausted; it may be obtained from the Superintendent of Documents. Price, 15 cents.

known pertaining to the old Chinese hog and its influence in the formation of modern breeds. (Variation of Animals and Plants under Domestication, pp. 68–82; The Study of Breeds in America, pp. 276–282; Domesticated Animals and Plants, pp. 231–233.)

54 Recitation. Berkshire and Poland China breeds.

The Berkshire is a native of Berkshire, England. Chinese, Siamese, and Neapolitan blood was used at an early date in its improvement. The type has been much changed in later years. The modern Berkshire is more active than other breeds of the lard type and produces a larger proportion of lean meat. Describe its other characteristics, as color markings, size, etc. The Poland China breed contains some blood from the Berkshire, but is an American breed, having originated in Ohio—one of the States of the Corn Belt. Accustomed to a liberal feed of corn, this breed has developed the proclivity to accumulate much fat in the carcass. They are very quiet in disposition. Point out other characteristics and compare with the Berkshires. (Types and Breeds of Farm Animals, pp. 472–496; The Study of Breeds in America, pp. 307–320.)

55 Practicum. Comparison of types and classification of modern breeds of swine.

With respect to size, the modern breeds of swine are classed as large, medium, and small. A more rational classification, based upon utility, is (1) the so-called lard, or fat, type, including such well-known breeds as the Berkshire, Poland China, Chester White, and Duroc Jersey, and (2) the bacon breeds—Large Yorkshire, Tamworth, and Hampshire or Thin Rind. Have the students understand thoroughly the difference between pure-breds, crosses, and grades. The market classification of swine should also be considered. (The Study of Breeds in America, p. 282; U. S. Farmers' Buls. 100, pp. 11, 12; 411; 222, pp. 24–31.)

Select a sow or barrow of one of the lard breeds, and also one as nearly the same size as possible representing the bacon type. Place these two specimens side by side, keeping them separate by means of hurdles if unaccustomed to being together, and point out differences in conformation, emphasizing also the tendency of one to develop fat in excess, this type having full hams and shoulders and being blocky in build; the other type, predisposed to convert less food into fat and more into lean, having deep, long sides, and small hams and shoulders. Score by comparison one pair of Berkshires and one of Poland Chinas. (Types and Breeds of Farm Animals, pp. 467–471, 532–535; Judging Live Stock, pp. 145–154; Swine, pp. 12–27; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61, pp. 82–93; U. S. Dept. Agr., Farmers' Buls. 100, p. 8; 411.)

56 Recitation. Chester White and Duroc Jersey breeds.

These are both of American origin, the former coming originally from Pennsylvania and the latter from New Jersey and New York. Compare size, color markings, fecundity, and other characteristics of these breeds with those of the Berkshire and Poland China. If there is another lard breed of local importance, give it similar attention. (Types and Breeds of Farm Animals, pp. 497–513; The Study of Breeds in America, pp. 287–293, 327–332; U. S. Dept. Agr., Farmers' Buls. 100 and 411.)

57 Recitation. Bacon breeds.

Something of the origin of each of the breeds Large Yorkshire, Tamworth, and Hampshire should be known. More emphasis, however, should be given to the study of the characteristics of each of these breeds. (Types and Breeds of Farm Animals, pp. 536–553; The Study of Breeds in America, pp. 295–306; Swine, pp. 32–35, 40–41.)

58 Recitation. Hog cholera.

Hog cholera is very prevalent throughout the Corn Belt and is the cause of larger losses to swine raisers than ony other disease, or all others together. Much progress has been made very recently in the discovery of methods of successfully combating it. The cause, symptoms, and treatment of hog cholera should be carefully considered. (The Care of Animals, pp. 388–395; Swine; U. S. Dept. Agr., Farmers' Bul. 379.)

POULTRY.

59 Lecture. Races of domestic poultry.

Domestic fowls are supposed to have come from wild forms, the majority of the breeds from the jungle fowl of India (*Gallus bankiva*), a small bird weighing about 3½ pounds. The wild hen nests but twice each year, laying from 22 to 26 eggs. By methods of breeding, hens laying as high as 200 eggs per year have been developed. In other varieties of domestic fowls size has been greatly increased. Nearly all large varieties were developed in eastern Asia. Though there are many breeds of fowls in the Old World not known in the New, it is safe to say that the best breeds of the world are well represented here, some of the most useful and beautiful of these having been developed in America. The American Standard of Perfection recognizes over 100 breeds and varieties of fowls in America. These are sometimes classed with reference to their origin, as American, Mediterranean, Asiatic, English, French, Dutch, and Polish, with special classes for Games, Bantams, and others. A classification, however, based upon distinction in type—utility rather

than origin—is more convenient and practical and is here given, as follows:

Group I. Meat type.
II. General purpose type.
III. Laying, or egg type.
IV. Ornamental breeds.

Name the more common breeds of each class. (Races of Domestic Poultry; Variation of Animals and Plants under Domestication, pp. 236–290.)

60 Practicum. Comparing types.

Procure a good hen of the meat type—Brahma, Cochin, or Langshan; one about the same age of the laying type—Leghorn, Minorca, or Hamburg; and a third of the general-purpose type—Plymouth Rock, Wyandotte, Rhode Island Red, or Orpington. Point out to the class that between these three types there is a divergence of conformation and character as fairly established as in the various types of domestic animals. In the meat type, as shown in the Asiatics, which are typical of this class, we have a short, wide back with body deep and boxlike in form, capable of carrying large quantities of flesh. The back of the fowl of the laying type, it will be observed, is noticeable for length of line. Note the full chest, carried well out, and the remarkable development of the abdomen. We see in this how nature has fitted these hens for egg production, the large abdomen giving evidence of capacity and the full chest showing stamina. Though belonging to the meat class, the Indian Game and the Dorking do not correspond to the Asiatic in form. Their place in this group is accorded them by reason of a peculiarly large and well-developed breast, which makes them desirable for table use. (U. S. Dept. Agr., Farmers' Bul. 51, figs. 13, 20.) The general-purpose fowls are in shape a compromise between the two more extreme types. They are formed to produce more eggs than the fowls of the meat class and more pounds of meat than the members of the laying class. Feathering is much more abundant with the meat class than with the egg producers. Considerable food material which in the Leghorn or Minorca would be utilized in egg production is by the Cochin or the Brahma converted into fluff and feathers. The comb also indicates prolificacy, the large comb going invariably with the fowls excelling in egg production, the small or rudimentary with the meat producing types, and the medium size with the fowls having a dual purpose.

Point out that these types also differ distinctly in habits and disposition. The laying breeds are nervous, alert, active, foraging early and late. The larger, heavier meat breeds are slow in movement, quiet in disposition, as would be expected of a breed the

natural tendency of which is to take on fat—a tendency which becomes more apparent as the fowls increase in age. Fowls of the general-purpose type are a blending of the two other types, neither so active as the one nor so phlegmatic as the other.

Let the student learn some of the more conspicuous external characters of the fowl, as neck hackle, back, saddle hackle, chest, breast, tail, sickle feather, coverts, wing primaries, wing secondaries, etc. Consider the different forms of comb. Explain what is meant by barred, spangled, penciled, and other markings. (The Perfected Poultry of America; Races of Domestic Poultry, pp. 20–21.)

Procure two or more specimens of one of the Asiatic breeds. Go over one of the specimens carefully with the class, calling attention to all the "points," using as a guide the description given in American Standard of Perfection for the breed under consideration. Then allow students to score the birds. (Progressive Poultry Culture, p. 235; for score card see U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61.)

61 Recitation. The meat breeds.

Have students study the history of the three members of the Asiatic class and become familiar with the varieties of each family. A characteristic common to all is the feathering of leg and foot, it being particularly abundant in the case of the Cochin. Observe that the cushion above the tail in this family is absent in the other two. (American Standard of Perfection; The Perfected Poultry of America; Races of Domestic Poultry, p. 56; U. S. Dept. Agr., Farmers' Bul. 51, p. 12.)

The pupils should look up the history of the Dorking. How did this breed acquire its name? Call attention to the peculiarity of this breed—the fifth or supernumerary toe. The only other breed possessing this characteristic is the Houdan. (Races of Domestic Poultry, p. 24; U. S. Dept. Agr., Farmers' Bul. 51, p. 37.)

Have the pupils read an account of the introduction of Game fowls into England and a description of the national sport of cock-fighting which was suppressed by act of Parliament in 1849. (Races of Domestic Poultry, p. 33.) The Indian aseel brought into the district of Cornwall, England, and crossed with the Old English Game became the foundation stock of the Cornish Indian Game. The stout thighs, long legs, and big breast of the Cornish Indian and other Game birds were developed by breeding to render them more "redoubtable in war." (Races of Domestic Poultry, pp. 41, 61.)

62 Recitation. The laying breeds.

The laying group includes the Mediterranean class, the so-called Dutch class, and the English Redcap. The Mediterranean breeds are

supposed to have come originally from countries bordering the Mediterranean Sea, as the Leghorn and Ancona from Italy; the Minorca, White Faced Black Spanish, and Blue Andalusian from Spain. Each of these breeds includes one or more varieties. The Leghorn, which may be considered the leading family in this class, has no less than eight varieties, differing from one another only in such unimportant details as color of plumage or form of comb. (American Standard of Perfection; The Perfected Poultry of America; Races of Domestic Poultry, p. 71; Farm Poultry, pp. 22–31; U. S. Dept. Agr., Farmers' Bul. 51, p. 19.)

The White Faced Black Spanish, formerly very popular because of the size of the egg it produces, has been superseded by the Minorca, also a layer of large white eggs, but a bird of more pleasing appearance and a better table fowl. The Blue Andalusian is closely related to the Black Spanish and the Minorca. Though a bird of great laying ability and plumage unique in color, it has never become popular in America. (Races of Domestic Poultry, p. 99; Farm Poultry, pp. 31–35; U. S. Dept. Agr., Farmers' Bul. 51, p. 25.)

The Hamburg, with the exception of the two penciled varieties which were developed in the Netherlands, is supposed to have originated in England. Its history is closely connected with the history of the Redcap, which may have descended later from a coarsely bred Gold-Spangled Hamburg and an Old English Game. The name Redcap is derived from the extremely large rose comb of this breed. (American Standard of Perfection; The Perfected Poultry of America; Races of Domestic Poultry, pp. 44–50; Farm Poultry, pp. 35–38; U. S. Dept. Agr., Farmers' Bul. 51, pp. 30–35.)

63 Recitation. General purpose breeds.

The general-purpose group, as understood in America, comprises the American class, the Orpington (English), and the Houdan (French). The following breeds constitute the American class: The Plymouth Rock, the Wyandotte, the Dominique, and the Rhode Island Red. The Plymouth Rock is the most popular fowl in America, the barred variety taking precedence over the others. The Wyandotte, also a favorite, has the largest number of varieties of any American breed. The youngest of these is the Columbian, named to commemorate the World's Columbian Exposition, which year saw the development of the breed in its finished state after years of careful selection and mating. We are indebted to the same breeder for the White Wyandotte, which variety has had more to do than any other in bringing the breed into prominence. The latest breed in the American class to secure recognition and favor is the Rhode Island Red, by many considered the most beautiful of our domestic birds, because of the rich color of its plumage. (American

Standard of Perfection; The Perfected Poultry of America; Races of Domestic Poultry, pp. 149–165; Farm Poultry, pp. 54–65, 67–70, and 72; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 29;[a] U. S. Dept. Agr., Farmers' Bul. 51, pp. 6–10.)

The Orpington, England's latest contribution to poultry culture, has become an acceptable fowl in America. There are ten varieties of this breed, the latest being the Diamond Jubilee, named in honor of the seventy-fifth anniversary of Queen Victoria's birth. The Houdan is gaining ground in the United States, especially in the drier climates of the interior, as the crest in damp climates causes the fowl to be more susceptible to colds. In the Orpington and Houdan, as well as in the Dorking and Redcap, we see indicated the preference in England and France for fowls having white skin. In the American breeds is shown our national fancy for yellow-skinned fowls. (Races of Domestic Poultry, pp. 52, 89; U. S. Dept. Agr., Farmers' Bul. 51, pp. 29, 34.)

64 Recitation. The ornamental fowls and pigeons.

Ornamental fowls are kept for pleasure rather than for utility. While the Polish are good layers, their exceedingly high crests make them unfit for practical use. The eight varieties with their showy crests, some with wattles, some with beards, are a very imposing sight, the white-crested black being one of the handsomest. The Games have already been considered in connection with the Cornish Indian Game. The Game Bantams are simply diminutive Games. The Bantam class, which is large, contains some odd and interesting birds, as the Booted White, the Black Tailed Japanese, etc., besides the common Bantam breeds. Sultans, Silkies, and Frizzles are purely ornamental in their mission. The best place to study these breeds is at poultry shows and fairs, and it is to be hoped that students will avail themselves of every such opportunity. (Farm Poultry, pp. 74–81; U. S. Dept. Agr., Farmers' Bul. 51.)

In the study of pigeons, give most attention to those varieties used for squab raising, briefly considering the fancy varieties. (Pigeons, and All About Them; U. S. Dept. Agr., Farmers' Bul. 177.)

65 Practicum. Judging general-purpose fowls.

Secure specimens of some variety of the Plymouth Rock, of the Wyandotte, and of the Orpington. Go over these carefully, making clear what is meant by "Plymouth Rock shape" and "Wyandotte shape," and show how the Orpington differs from these, and then ask the students to score the birds. (Progressive Poultry Culture, p. 235; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61.)

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[a] The Department's supply of this bulletin is exhausted. It may be obtained from the Superintendent of Documents. Price, 15 cents.

66 Recitation. Ducks and geese.

Note the origin of the domestic duck (*Anas boschas*). It is supposed to have descended from the wild Mallard, most of the breeds having been developed in Europe and Asia. The Black Cayuga is believed to have originated in the region of Lake Cayuga, New York. One breed, the Muscovy, is native of South America and may still be found there in its wild state. Ducks are more prized for meat than for eggs, though two breeds, the Indian Runner and the Pekin, are excellent layers. The latter is also a good market fowl. The Aylesburg and the Rouen are the best meat breeds. Study the history and description of these four breeds. (Races of Domestic Poultry, pp. 5, 166; Farm Poultry, pp. 237–245; U. S. Dept. Agr., Farmers' Bul. 64.)

The domestic goose (*Anser cinerens*) is thought to have descended from the wild graylag, which may be found in almost any part of Europe. The goose is the oldest of our domestic races of poultry. It was a sacred bird in Egypt 4,000 years ago. Pictures of flocks of geese being driven home from pasture are found on ancient Egyptian monuments. The eggs "hatchen in dung" of which ancient historians wrote, were probably goose eggs. During the middle ages the goose was valued for its quills, of which the pens of that time were made. This bird has been prized for centuries for its down and feathers, which are more valuable than those of the duck. The Roman goose, the most interesting historically, is also considered the best layer of any of the breeds. Those most prized for meat are the Toulouse, the Embden, the Chinese, and the African. (Races of Domestic Poultry, pp. 6, 180–185, 189–193; Farm Poultry, pp. 250–256; U. S. Dept. Agr., Farmers' Bul. 64.)

67 Recitation. Turkeys and guineas.

Turkeys are the one race of poultry indigenous to America. The wild birds were highly prized as food by the early settlers and pioneers as well as by the natives. In 1524 turkeys were introduced into England, where they thrived so well that in 1575 they had become "a Christmas dish with the farmer." Study the history of the breeds of turkeys, giving particular attention to the Bronze, sometimes called the American Bronze. What did Benjamin Franklin think of this bird? (Races of Domestic Poultry, p. 193; U. S. Dept. Agr., Farmers' Bul. 200.)

The guinea so far has been the object of but little attention. As the market value increases it will receive more consideration from breeders. There is but one variety common in America, the Pearl guinea, though a White variety is claimed by some breeders. These are said to be tamer than the Pearl. (Farm Poultry, pp. 277–281; U. S. Dept. Agr., Farmers' Bul. 234.)

68 Recitation. Parasites of poultry.

Poultry of all kinds may become the victims of various parasites. These may be either internal or external. Both classes are capable of causing serious loss to the poultry keeper, though the external parasites are more common, and undoubtedly cause more trouble. Some good disinfectant used occasionally in the drinking water will go far toward ridding the digestive tract of internal parasites, and there are simple and effective methods of combating the external pests. Dry dust for a bath, furnished summer and winter, gives healthy hens an opportunity to keep their bodies free from lice, but they have no means of defending themselves from the attacks of mites. Explain why this is true. This important lesson should be fully discussed. (Profitable Stock Feeding, pp. 328–331; Farm Poultry, pp. 308–313; U. S. Dept. Agr., Farmers' Buls. 190, p. 6; 287, p. 47; 305, p. 28.)

69 Recitation. Common diseases and their treatment.

To know how to prevent disease is far better than to know how to cure it. The most common poultry diseases are roup and contagious indigestion. The latter is sometimes mistaken for cholera, which is rare. Roup is difficult to cure, but may be easily prevented by using properly built and properly ventilated poultry houses. The best safeguard against contagious indigestion is wholesome feed and cleanliness. Disinfectants should be used about the houses occasionally to destroy any disease germs that may be present. Crops should be raised or lime scattered about the yards to prevent ground poisoning. No fowl afflicted with any contagious disease, be it cholera, roup, tuberculosis, blackhead, chicken pox, or scaly leg, should be allowed to mingle with the flock after the first symptom is observed. A knowledge of the symptoms of these diseases is necessary in order to be able to detect them if they appear. What is the cause of limber neck, of bumble-foot? (Farm Poultry, pp. 316–326; Progressive Poultry Culture; U. S. Dept. Agr., Farmers' Buls. 287, pp. 42–47; 305, p. 28; 357, pp. 34–36; Oregon Station Buls. 64, 96.)

70 Practicum. Judging laying fowls.

Obtain, if possible, two or more specimens of several varieties of these breeds—for instance, two or more Rose-Comb Brown Leghorns, two or more Single-Comb White Leghorns, Black Minorcas, or Hamburgs of some variety—and allow the students to score them. (Progressive Poultry Culture, p. 235; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 61.)

FEEDING AND CARE OF FARM ANIMALS.

71 Lecture. Animal production as influenced by food supplied.

The adaptability of the animal to the particular purpose for which it has been bred, however important it may be as a factor influencing

economy of production, is probably no more so than the effect of the ration fed. Insufficient data on types of animals have been developed to give a reliable comparison of these two factors. The Illinois Experiment Station found that a good class of well-bred feeding steers made 11 per cent larger gains than inferior types on an equal amount of the same kind of feed. At the Nebraska Station there was little difference in gains, but a considerable difference in the quality of the finished product. With the dairy cow the difference in favor of approved types is greater.

A large amount of data on the relative efficiency of rations has been obtained which would indicate that the product may be increased fully 30 per cent and the quality also improved by the use of well-balanced rations in contrast with poorly balanced ones. With young animals the difference is still more marked. Other facts may be presented which will impress upon the minds of the students the importance of a knowledge of animal requirements and feedstuffs to one engaged in the business of feeding animals. Describe to the class the structure and composition of animal products—meat, milk, eggs, etc.—maintenance requirements, and metabolic processes. It is assumed that the student has studied chemistry. (Profitable Stock Feeding, pp. vi, 7–11; Elements of Agriculture, pp. 281–300; U. S. Dept. Agr., Farmers' Bul. 22, p. 3; 346.)

72 Recitation. Composition of feeds.

Question the students on the preceding lecture, so that they will have a fairly accurate understanding of the composition of fat and lean tissue, bone, the component parts of milk—the chemistry of products into which feed is to be converted. Have them next learn about the composition of feeding stuffs and the distinctions between the various groups of compounds—water, ash, fat, carbohydrates, and protein—and the uses of each in the animal economy. Give illustrations of common forms of protein, such as gluten of wheat, the portion which remains in the mouth as "gum" when wheat is chewed and which gives to bread dough its tenacity. (Profitable Stock Feeding, pp. 12–18; Feeds and Feeding, pp. 1–11; U. S. Dept. Agr., Farmers' Bul. 22, pp. 4–5.)

73 Recitation. The physiology of digestion and assimilation.

The course of the food as it passes through the alimentary tract into the circulation should be traced with some minuteness. The changes in food as effected by the different digestive fluids should also be known. The whole object of digestion is to render the food soluble so that it may pass through the membranes into the blood, which carries it to the parts of the body where it is used or stored for the future. (Feeds and Feeding, pp. 12–26.)

74 Recitation. Digestibility of feeds and feeding standards.

Farm grains and other concentrated foods are much more digestible than coarse kinds, such as hay, straw, and cornstalks. The digestible nutrients in feeds rather than their composition as determined by chemical analysis should be used in compounding rations. What is meant by "nutritive ratio," "balanced ration," etc.? Discuss the feeding standards fully and have students calculate a few simple rations by use of the tables. (Profitable Stock Feeding, pp. 19–31; Feeds and Feeding, pp. 26–39; U. S. Dept. Agr., Farmers' Buls. 22, pp. 7–15; 346.)

75 Practicum. Judging stock.

Practice in judging should be continued once each week throughout the year, giving more attention to that class of animals which is most important locally. If further work is done with all farm animals, it would better be continued in the following order: Poultry, swine, sheep, cattle, and horses, because of weather conditions. Horse judging should be done outdoors in early fall and late spring.

76 Recitation. Quantity and quality of feed, regularity in feeding, and care applicable to all animals.

Emphasize the fact that since approximately half the ration goes for maintenance a system of liberal feeding is most economical so long as the animal's digestive system is not overtaxed, which seldom happens, and material is not left uneaten in the feeding racks; and, further, that the proportion of roughage to grain is such as to meet the needs of the particular animals fed. Point out also the importance of having all feed clean and palatable and supplied with regularity. Young people especially should be brought to a full realization of the need of more kindness to dumb brutes and its economic importance. (Profitable Stock Feeding, pp. 31–36; Missouri Station Bul. 65.)

STOCK FEEDS.

77 Recitation. Farm grains as feed for stock.

With respect to physical texture all feeds may be divided into two general groups, concentrates and roughage, the former including the cereal grains, certain by-products, such as linseed meal, wheat shorts, etc., and the latter embracing hay, cornstalks, and other coarse material. With respect to composition, each of these two groups could again be divided, the first division containing those high in carbohydrates and deficient in protein, and the second those containing protein in excess of animal requirements. Corn belongs to the first division of the first group, and because of its large use as a feedstuff in America should receive first consideration. Compare it with barley, emmer, rye, oats, and wheat. The last-named grain is ordinarily too high-priced for feeding animals. (Feeds and

Feeding, pp. 119–135; U. S. Dept. Agr., Farmers' Buls. 139, pp. 11–13; 305, pp. 17–19.)

78 Recitation. Plant by-products as protein concentrates.

The class should discuss the composition, preparation, and uses of cotton-seed meal, linseed meal, gluten meal, wheat bran, shorts, and other plant by-products. (Profitable Stock Feeding, pp. 80–86; Feeds and Feeding, pp. 148–162; U. S. Dept. Agr., Farmers' Buls. 22, pp. 19–24; 305, pp. 16–17.)

79 Recitation. Animal by-products as protein concentrates.

Have the pupils describe the preparation, etc., of skim milk, buttermilk, beef scraps, tankage, and dried blood. (Profitable Stock Feeding, pp. 298–303; Feeds and Feeding, pp. 220–221, 228.)

80 Practicum. Stock judging.

After the student has become fairly familiar with the scale of points for any particular class of animals the work on that class should be continued by the use of specially prepared blanks or the back of the score card. This work consists of ranking in their order of merit three or more animals, the student putting in writing his reasons in detail for such placement. Each animal should bear a number on a small paper sticker. After the papers are handed in a general discussion should follow and the correct ranking be given by the instructor, accompanied by his reasons. The papers should be examined, graded on the basis of 60 per cent for placement and 40 per cent for reasons, and returned to the student after the grade is recorded.

81 Recitation. Roughage—corn fodder, stover, and silage.

Corn fodder, also called shock corn or bundle corn, is the entire plant cured in the field by cutting and putting it in shock when first ripe. Corn stover is the stalk after the ear has been detached. Corn silage is the entire plant preserved in a moist and somewhat greener condition in the silo. The largest number of pounds of digestible nutrients per acre is obtained when corn is cut for the silo just a few days before it would be ready to shock. If left too long it will not pack so well. Give some time to the discussion of silage and of silo building and filling. (Profitable Stock Feeding, pp. 58–73; Feeds and Feeding, pp. 245–252; U. S. Dept. Agr., Farmers' Buls. 32; (T) 133, pp. 31–32; (T) 292; (T) 316, pp. 99–101.

82 Recitation. Sorghum and millet hay.

Discuss with the pupils the value of sorghum as a pasture plant, for silage, and hay. Millet yields well and is a fairly good forage crop for certain purposes, but is not safe for horses. (Feeds and Feeding, pp. 188–190; Profitable Stock Feeding, p. 87; U. S. Dept. Agr., Farmers' Buls. 101, pp. 24–25; 168, pp. 13–15; 246, pp. 30–36; 288, pp. 21–25.)

83 Recitation. Timothy, redtop, and prairie hay, and bluegrass pasture.

Describe the feeding value of the two of these hay plants most common locally and how they should be cured to make the best feed. What are the merits of bluegrass, also called June grass, for pasture purposes? (Feeds and Feeding, pp. 178–187; Profitable Stock Feeding, p. 87.)

84 Recitation. Leguminous hay plants.

Discuss fully clover, alfalfa, cowpea hay, and soy beans. All these forage plants contain protein in excess of requirements for most animals and are therefore especially valuable for feeding with grains deficient in this nutrient, as, for example, corn and barley. (Feeds and Feeding, pp. 195–209; Profitable Stock Feeding, pp. 55–58, 77; U. S. Dept. Agr., Farmers' Bul. 56, pp. 4–8.)

85 Practicum. Continue judging animals as directed in exercise 80.

86 Recitation. Roots, beet pulp, and cassava.

Describe the feeding value of each of these feeds. (Feeds and Feeding, pp. 211–218; U. S. Dept. Agr., Farmers' Buls. 22, pp. 24–32; 162; 167; 262, pp. 19–23.)

87 Recitation. Rape and cabbage.

The rape plant is especially valuable for sheep, though it is also used to a considerable extent for hog pasture. It does not cure well when cut, and must be used as a soiling or pasture plant. Cabbage is sometimes fed to stock when low in price. (Profitable Stock Feeding, pp. 212–219; Feeds and Feeding, pp. 218–219; U. S. Dept. Agr., Farmers' Buls. 164, pp. 11–14; 305, pp. 22–24.)

88 Recitation. Condimental stock feeds.

The pupils should learn how these feeds are prepared and whether or not they merit the claims made for them by the manufacturers. (Profitable Stock Feeding, pp. 94–96; Feeds and Feeding, pp. 229–230; U. S. Dept. Agr., Farmers' Buls. 73, pp. 25–26; 144, pp. 22–24; 233, pp. 21–22.)

HORSES.

89 Recitation. Horse barns and stable construction.

As an introductory to the feeding of horses devote one period to the study of horse barns, the arrangement of stalls, feed bins, ventilation, etc. (Farm Buildings, pp. 90–123; Michigan Station Bul. 250, pp. 45–63.)

90 Practicum. Take the class to one or more modern horse barns in the community for the purpose of making observations on horse barns, stalls, and other features of construction.

91 Lecture. Feeding horses for work.

Show that heat and energy are from the same source and that one may be transformed into the other. Give illustration. Show how heat from the sun is stored in the plant in latent form during the processes of growth by the union of chemical elements to form plant compounds and how this is liberated during the process of digestion and is converted into energy. Make it clear that fats are capable of giving out approximately 2.25 times as much heat or energy as either carbohydrates or protein because of the large amount of carbon contained and the complexity of fat compounds. Protein is needed to repair worn-out tissue, but the energy itself may all come from the nonnitrogenous constituents. Recent investigations indicate that much less protein is required by horses at work than is stipulated in the Wolff-Lehmann standards. (Profitable Stock Feeding, pp. 361–364; Feeds and Feeding, pp. 274–288; U. S. Dept. Agr., Farmers' Bul. 170, pp. 28–42.)

92 Recitation. Rations for work horses.

Discuss the value of the different cereal grains for work horses—corn, oats, barley, etc.; the several forms of roughage best suited for them—timothy, prairie hay, sorghum, corn stover; and the care to be exercised in the use of alfalfa and clover. (Feeds and Feeding, pp. 292–300; Profitable Stock Feeding, pp. 368–374; U. S. Dept. Agr., Farmers' Buls. 133, pp. 29–30; 162, pp. 16–21; 170, pp. 9–14; 222, pp. 19–24.

93 Recitation. Molasses, roots, cotton-seed meal, and linseed meal for work horses.

Describe the use of these feeds and also the economy of grinding grain or chopping hay for horses. (U. S. Dept. Agr., Farmers' Buls. 170, pp. 14–25; 222, pp. 19–24; 316, pp. 102–104.)

94 Recitation. Feeding and care of driving horses, brood mares, and colts.

Brood mares need more protein than work horses, which is also true of the foal. Road horses should not have laxative feeds in quantity. (Feeds and Feeding, pp. 311–330; Profitable Stock Feeding, pp. 375–379.)

95 Practicum. Stock judging continued.

DAIRY CATTLE.

96 Lecture. Feeding for milk production. Equipment.

In giving the opening lecture on feeding dairy cattle, show first how the industry has grown in the United States and explain why, as the country becomes more populous, the production of milk tends to increase more rapidly than the production of beef. Discuss dairy

barns, stalls, ventilation, water, salt, etc. The dairy cow needs much more protection from the cold than the beef cow or steer, because she carries but little flesh. On the other hand, close housing in poorly ventilated barns is a most favorable condition for the spread of tuberculosis in the herd, a disease which is now giving much concern throughout the farming section of the country. (The Farm Dairy, pp. 7–17, 46–58; Profitable Stock Feeding, pp. 37, 45–47; Feeds and Feeding, pp. 410–412; Dairy Farming, pp. 86–100; U. S. Dept. Agr., Bur. Anim. Indus. Circ. 131; U. S. Dept. Agr., Farmers' Buls. 55, pp. 10–12; 144, pp. 30–32; 169, pp. 5–8; 190, pp. 23–31; 244, p. 32; 296, pp. 25–27; 349; Wisconsin Station Buls. 164, 185.)

97 Recitation. Nutrient requirements for milk.

If the student understands the maintenance requirements of the dry cow and the composition of milk it will be plain that the more of this highly nitrogenous product the cow gives the more protein she requires in her ration. If a particular individual gives milk high in fat it will also be apparent that she can utilize a larger amount of carbohydrates than one giving the same quantity of milk low in fat. Discuss the importance of succulence in the ration and the most economical proportion of roughage to concentrates. Give the students practice in calculating rations for cows giving a certain quantity of milk. (Profitable Stock Feeding, pp. 48–54; Dairy Farming, pp. 35–52; (T) Feeds and Feeding, pp. 437–448; U. S. Dept. Agr., Farmers' Buls. 114, p. 25; 119, pp. 25–26; 202, pp. 22–24.)

98 Recitation. Feeding the fresh cow in winter.

The production of milk in winter is favored by many farmers because they then have more time at their disposal to do the necessary work. By the judicious use of grain and silage and other roughage of the right sort, the flow of milk in winter may be made quite as great and perhaps as cheaply as on grass in summer, and the product will bring more in the winter season. Describe rations most in favor locally for giving large returns at low cost. In most sections of the United States this would be some combination of corn, corn silage, and clover or alfalfa, with perhaps a little linseed meal or some other protein concentrate. Liberal feeding is most economical. (Feeds and Feeding, p. 467; Profitable Stock Feeding, pp. 55–60; Dairy Farming, pp. 73–74; U. S. Dept. Agr., Farmers' Buls. 251, pp. 26–30; 267, pp. 29–31.)

99 Recitation. Results of experiment station tests.

It would be well to spend the entire period discussing experiment station feeding tests for milk production, giving consideration to the comparative value of protein concentrates, and the preparation of feeds and different kinds of roughage suitable for cows. (Feeds and

Feeding, pp. 413–435; U. S. Dept. Agr., Farmers' Buls. 267, pp. 29–31; 320, pp. 164–165.)

100 Practicum. Take the class to dairy farms to inspect barns, stalls, yards, and other equipment.

101 Recitation. Summer feeding for milk and the care of other dairy stock.

What pasture grasses are most suitable for cows? Is it profitable to feed grain while cows are on grass? Show the value of soiling crops in summer to supplement pastures.

The productive capacity of the milk cow depends quite as much upon her care following the period of lactation as during that period. One must avoid "over conditioning," which tends to stimulate the beef tendencies and to suppress that of milk production. On the other hand, poorly nourished dry cows have less vigorous calves and start giving milk with little reserve force, which is a serious handicap. The dry cow needs but little grain if she is supplied with an abundance of some good protein roughage, as alfalfa or clover. Change to heavy feed must be gradual after calving. Emphasize also the importance of kindness to the cow, an animal exceedingly sensitive to disturbance of any sort and one which shows it in her production. Give some attention also to the feeding of the dairy bull and young heifers. (Profitable Stock Feeding, pp. 97–102; Feeds and Feeding, pp. 466–468; Dairy Farming, pp. 74–79; U. S. Dept. Agr., Farmers' Buls. 190, pp. 8–14; 317, pp. 134–135.)

102 Recitation. Rearing calves on skim milk. The relative economy of skim milk and whole milk in raising calves.

The calf is very responsive to good or poor treatment, and its feeding must be done with great care. Consider carefully all the details, the change from whole milk to skim milk, the use of fat substitutes, the importance of cleanliness, the later use of farm feeds, etc. (Profitable Stock Feeding, pp. 103–111; Feeds and Feeding, pp. 334–342; Dairy Farming, pp. 82–85; U. S. Dept. Agr., Farmers' Buls. 202, p. 24; 233, pp. 22–25; 273, p. 17.)

BEEF CATTLE.

103 Lecture. Beef production. The beef industry in the United States.

Most of the beef produced in the United States is grown by two classes of producers working under widely dissimilar conditions. In the "range district" vast herds of cows of mixed breeding, many of them high grades of the beef breeds, are pastured throughout the year on the rough, semiarid lands of the West. This district is a section of territory occupying the eastern slope of the Rocky Mountains, comprising several entire States and parts of others. Point

out the location of this territory on the map. These cows are mated to beef bulls, and their offsprings are grown on grass, sometimes supplemented with hay in winter, and shipped to the stock markets when 2, 3, or 4 years old. They are full-grown in frame, but thin in condition. These are purchased by farmers in the corn belt, fattened on grain and hay, and shipped back to the markets for slaughter. Much territory formerly occupied by ranchmen has been recently sold for purposes of cultivation by so-called "dry-farming methods," and range cattle have been correspondingly reduced in number. From now on it is probable that much more beef will be both grown and fattened on farms, a large part of it consisting of the offspring of dairy cows, for it is only on cheap lands that we can afford to keep a cow a full year in return for a single calf. To be profitable, a farm cow must give enough milk to more than raise one calf. Frequently those of dairy breeding and some grade Shorthorns give enough to suckle two calves the first four or five months and a third during the remainder of her lactation period. Where milk is sold for cheese making or condensing, some of the cows which are difficult to milk are often used for this purpose. Not all of the heifer calves are usually needed for the perpetuation of the dairy herd, and some cows may therefore be bred to low-down, thick-fleshed beef bulls, the calves from such a mating being very satisfactory for beef making—much better than if from dairy parentage on both sides. Male calves not sired by a dairy-bred bull and not intended for breeding purposes would better be vealed. Show how veal is best made. (Feeds and Feeding, p. 343; U. S. Dept. Agr., Farmers' Bul. 233, p. 22.)

104 Recitation. Feed lots and shelter for beef cattle.

Because of their full flesh and heavy rations, fattening cattle need but little protection from the cold, but should have a dry, comfortable place to lie down. Muddy or rough frozen grounds will cause cattle to stand most of the time, thus expending much of the energy of food which should go to form meat. Show why the feed lot should be roomy, on a south slope, and protected from cold winds. Discuss feed racks, water supply, salt, etc. (Profitable Stock Feeding, pp. 143–149; Beef Production, pp. 143–157; Feeds and Feeding, pp. 391–392; Farm Buildings, pp. 52–88; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 108, pp. 78–83; U. S. Dept. Agr., Farmers' Buls. 251, pp. 22–25; 262, pp. 23–25.)

105 Practicum. Visit cattle-feeding barns and sheds. Observe arrangement of feed yards, racks, etc.

106 Recitation. Baby beef production.

Cattle finished for market ranging from ten to eighteen months of age are designated as "baby beeves." Young beef is profitable when one has a class of low-down, blocky cattle of extreme beef type, which

will fatten rapidly at an early age and has also the kinds of feed best suited for early fattening. It is a system to be recommended when there are other classes of stock to consume the greater part of the roughage grown on the farm. Heifers intended for beef naturally fatten earlier than steers, and when made into baby beef need not be spayed. (Profitable Stock Feeding, pp. 150–155; Beef Production, pp. 76–81; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 108, pp. 48–50; Bur. Anim. Indus. Circ. 105; U. S. Dept. Agr., Farmers' Bul. 73, pp. 27–28.)

107 Recitation. Fattening "long" yearlings.

Cattle fattened between eighteen and twenty-four months of age should have less grain and correspondingly more roughage during the first year than baby beeves. With good alfalfa or clover it is most profitable to feed from 2 to 4 pounds of grain per day during the first winter as calves, good grass, without grain, the following summer, and a liberal grain ration the second winter, while being prepared for market. (Profitable Stock Feeding, pp. 156–165; U. S. Dept. Agr., Farmers' Bul. 320, pp. 161–164.)

108 Recitation. Fattening 2-year-old steers.

Home-grown steers that have had an abundance of roughage and but little grain during the first two winters, or range-bred animals, may be handled very profitably by postponing the finishing process until the coming of grass, with which much less grain is required than with dry roughage. If one does not have sufficient pasture he would better fatten any home-grown calves as baby beef, or yearlings, or purchase range steers for winter feeding. Discuss most profitable rations for winter feeding. Range 3 or 4 year olds should be fed in the same manner except that they require relatively less protein because of being practically fully grown in frame. (Profitable Stock Feeding, pp. 165–186; Beef Production, pp. 104–110; U. S. Dept. Agr., Farmers' Buls. 251, pp. 25–26; 320, pp. 161–164.)

109 Recitation. Steer feeding experiments.

Give one period to a discussion of recent experiments with feeding stuffs for fattening cattle, giving special emphasis to the use of protein supplements and the preparation of rations. Marketing steers may also be considered. (Feeds and Feeding, pp. 345–360 and 394; Beef Production, pp. 59–63; U. S. Dept. Agr., Farmers' Bul. 296, p. 21.)

110 Practicum. Take the class to the nearest packing center, when a day may be spent observing methods of making sales, slaughtering animals, and handling carcasses and packing house by-products.

111 Recitation. Devote this period to a discussion of the observations made the preceding day. How much beef, pork, and mutton do we export annually, and to what countries are they shipped?

112 Recitation. Dipping cattle for scabies and lice.

In the range district of the West scabies gives considerable trouble. It yields readily to dipping solutions, which should be carefully studied. Compare different kinds of cattle dipping appliances and the several dips in use. Study also the life history of the cattle bot fly, also called ox warble and cattle grub. (The Care of Animals, pp. 322–327, 333–334; U. S. Dept. Agr., Farmers' Bul. 152.)

SHEEP.

113 Lecture. Mutton production; equipment.

Call attention to the fact that at least a few sheep should be kept on practically every farm. Mutton has been high in price for several years and the conditions are favorable for a continuation of profitable returns. Sheep will convert troublesome weeds into meat, thus ridding the pastures and converting into cash material that is worthless for other animals and a detriment to the farm when left to produce seed. Dogs and coyotes sometimes do much harm to a flock. Discuss buildings, fences, racks, and troughs. (Sheep Farming in America, pp. 13–19, 85–89; Profitable Stock Feeding, pp. 191–200, 204, 220–224, 240; Feeds and Feeding, pp. 514–516; U. S. Dept. Agr., Farmers' Bul. 96, pp. 4–6.

114 Recitation. Care of the breeding flock.

The feeding of the ewe is important, because undernourishment results in weak lambs, in which case the mortality at birth is high. On the other hand, too much fatness in the ewe is not desirable at lambing time. With alfalfa or clover very little grain is needed, and this may consist of equal parts of corn, oats, and bran, a half pound per day to each ewe. After the lambs are born this allowance should be gradually increased until the flock is turned on pasture, when no grain is needed. Roots or silage will stimulate milk flow before grass comes. Ewes and lambs require skillful attention, which should be discussed in detail. (Sheep Farming in America, pp. 72–84, 89–106; Profitable Stock Feeding, pp. 204–207; (T) Feeds and Feeding, pp. 517–521; (T) U. S. Dept. Agr., Farmers' Bul. 49, pp. 3–11.)

115 Practicum. Visit farmers in your community who own up-to-date sheep barns and sheds. Observe carefully construction and arrangement.

116 Recitation. Feeding lambs for early market.

Some consideration should be given to the so-called "hothouse lambs," which are produced in some Eastern States for special hotel

orders. These are born early in winter and forced for early spring market. March lambs may be well fattened for late summer market by feeding grain in a so-called "creep" while ewes are on pasture. If the ewes are of well-graded mutton stock and pastures are good lambs are often sold from the ewes without having had grain. (Sheep Farming in America, pp. 106–125; Profitable Stock Feeding, pp. 202–203; Feeds and Feeding, pp. 529–531; U. S. Dept. Agr., Farmers' Buls. 49, p. 12; 96, pp. 28–29.)

117 Recitation. Fattening lambs in fall and early winter.

Take up in detail the question of fall pastures, giving preference to alfalfa and clover, because both are high in protein and greatly relished. With such pasture, the grain allowance may consist entirely of shelled corn. Rape is also very valuable for sheep and lambs. Fall-fed lambs may be made ready for market off pasture or they may be finished in the dry lot. Describe rations. (Profitable Stock Feeding, pp. 208–231; Sheep Farming in America, pp. 143–155; U. S. Dept. Agr., Farmers' Buls. 49, pp. 13–17; 224, p. 5.)

118 Recitation. Feeding range lambs and yearlings for winter or spring market.

Range lambs are usually much better than others for winter feeding, because as a rule they are not infested with stomach worms. Discuss fully winter rations for lambs and yearlings and note results of experiment station tests. (Profitable Stock Feeding, pp. 232–248; Sheep Farming in America, pp. 217–230; Feeds and Feeding, pp. 490–492, 497–501; U. S. Dept. Agr., Farmers' Bul. 96, pp. 34–37.)

SWINE.

119 Lecture. Pork production. Equipment.

Unlike cattle and sheep, many of which are bred and grown in one section of the country and fattened in another, hogs are grown and fattened on the same farm, or at least in the same community. This is done for two chief reasons: (1) A few sows will produce a large number of pigs, and breeding such a limited number does not interfere seriously with the business of fattening for market; (2) there is great danger of contracting hog cholera in freight cars if stock hogs are shipped in for feeding purposes.

Because of their prolificacy but little capital is required to embark in the hog business, and they are therefore more universally kept on farms than any other class of animals, with the possible exception of poultry, which requires even less initial outlay. Their use as scavengers of the farm should be considered in class; likewise the construction of hog houses, farrowing and fattening pens (movable and stationary), and feeding troughs and other appliances. Give some attention to hog-lot sanitation, dipping solutions, etc.

(Profitable Stock Feeding, pp. 262–264; Swine, pp. 448–489; Farm Buildings, p. 146; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 47,[a] pp. 14–19; U. S. Dept. Agr., Farmers' Buls. 205, pp. 5–19; 296, pp. 27–29; Illinois Station Bul. 109; Wisconsin Station Bul. 153.)

120 Practicum. Inspect hog houses, both stationary and portable, on near-by farms.

121 Recitation. Care of the brood sow before and after farrowing.

March and April litters are usually in most favor. Mature sows can successfully raise fall pigs if the farm is well equipped with buildings. The size and vigor of the litter depends very largely upon the manner in which the sow is fed before and after farrowing. (Swine, pp. 106–138; Profitable Stock Feeding, pp. 265–269; Feeds and Feeding, pp. 604–607; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 47,[a] pp. 35–56; U. S. Dept. Agr., Farmers' Buls. 205, pp. 23–30; 411, pp. 8–11.)

122 Recitation. Feeding little pigs before and after weaning.

The weaning process should not be a checking one. By the proper use of skim-milk and grains it is possible to make the gains after weaning quite as rapid as those before, if the pigs are not weaned too early. (Profitable Stock Feeding, pp. 270–274; Swine, pp. 149–160; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 47,[a] pp. 56–60; U. S. Dept. Agr., Farmers' Buls. 202, p. 26; 205, pp. 32–34; 411, pp. 11–13.)

123 Recitation. Feeding spring pigs for the fall market.

Spring pigs may be made fat and large enough to market in the fall at the age of six to eight months. A system of liberal grain feeding on pasture is the cheapest method of producing pork. By disposing of the larger number of the spring pigs in the fall one avoids the difficulties of feeding pigs in winter. Consider the question of pastures, giving preference to alfalfa and clover, because they are high in protein and at the same time relished. Discuss also the question of grains for hogs. (Profitable Stock Feeding, pp. 273–279; Swine, pp. 160–188; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 47,[a] pp. 148–156; U. S. Dept. Agr., Farmers' Buls. 224, p. 5; 305, pp. 24–25; 331; 334, pp. 212–214.)

124 Recitation. Winter rations for fattening hogs.

Discuss the question of corn and its substitutes and the protein feeds most suitable for supplementing corn, such as skim milk, tankage, linseed meal, wheat shorts, alfalfa hay, etc. Is cotton-seed meal good for hogs? (Profitable Stock Feeding, pp. 280–303; (T) Swine, pp. 237–277; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 47,[a] pp. 97–133; U. S. Dept. Agr., Farmers' Buls. 169, pp. 29–30; 251, pp. 30–32; 259, pp. 22–24; 305, pp. 25–28; 316, pp. 105–110.)

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[a] In hands of Superintendent of Documents only. Price, 30 cents.

125 Practicum. Stock judging.

126 Recitation. The preparation of feeds for swine.

Review the results of experiment-station tests with grinding, soaking, and cooking feed, etc. (Feeds and Feeding, pp. 545–549, 556–559; Profitable Stock Feeding, pp. 304–307; (T) Swine, pp. 307–325; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 47,[a] pp. 77–89; U. S. Dept. Agr., Farmers' Bul. 276, pp. 21–25.)

POULTRY.

127 Lecture. Buildings for poultry.

Two systems of housing fowls are in use by poultry men and farmers: (1) The colony house, and (2) the continuous apartment house. Each system has its advantages. Expensive houses are not necessary for success with poultry. The chief requirements are: (1) A well drained soil. A porous soil is better than a heavy soil. Where the colony system is in use, an elevated situation is not so important, for these houses are equipped with runners or wheels in order that they may be moved frequently. (2) Houses should face the south or southeast, as the coldest winds are thus shut off and the most sunshine is secured. (3) Cleanliness is absolutely necessary. Houses should be so constructed that the inside can be sprayed or whitewashed without difficulty. Fixtures should be made so that thorough disinfection is possible. The best method is to have everything removable so that scalding water and sunshine may be used as cleansing agents whenever necessary. Feed hoppers, nest racks, and other appliances should hang on the wall or stand on blocks or legs. (4) Ventilation should be secured either by open-front houses or by the use of ventilators of some approved design. (5) There should be no draft on the fowls at night. For this reason perches should be placed in the most protected portion of the house. (6) Since exercise is necessary both for egg production and for health, a place for scratching should be provided either in the house itself or near it. (Profitable Stock Feeding, p. 333; Progressive Poultry Culture, p. 198; Farm Poultry, p. 82; U. S. Dept. Agr., Farmers' Buls. 227, p. 28; 287, p. 12; 357, p. 20; Oregon Station Bul. 96.)

128 Recitation. Poultry appliances.

The poultry keeper now finds certain appliances indispensable. Hoppers and racks for feed, nest boxes, etc., can be made at odd times, which will save many valuable minutes during the busy season. Hoppers, with separate compartments to hold grit, oyster shell, etc., may be made of light lumber, from soap boxes and crates. Larger ones may be made for the clover or alfalfa chaff gathered from the floors of feeding barns. Still others may be built for the

[a] In hands of Superintendent of Documents only. Price, 30 cents.

dry mash, though this may be fed to better advantage in racks, with slats running up and down, since more hens can feed at one time. There must be some device for keeping the drinking water clean, if none of the sanitary fountains upon the market are available, as disease is more likely to be contracted from impure water than in any other way. Many designs are exceedingly simple and easy of construction.

It will be found that the task of "hunting the eggs" is made much easier and pleasanter when a row of nest boxes is so arranged under the dropping board as to be opened in front by raising a board or letting one down the full length of the nest shelf. These nests are very attractive to the hens, as they enter from the rear, thus indulging, apparently, their natural instinct to hide the nest. A catching-hook can be made in a few minutes which will enable the farmer to readily sort out the fowls he wishes to sell or to use for his table. (Farm Poultry, pp. 112–123; U. S. Dept. Agr., Farmers' Buls. 287, p. 12; 357, p. 18; New York Cornell Station Bul. 248.)

129 Recitation. Incubators and brooders.

Chickens may be hatched naturally, that is, under hens; or artificially, by the use of incubators. By either method a large number of chickens can be raised successfully, but the time spent in caring for chickens with hens is much greater than when incubators and brooders are used. The first expense of the artificial method is greater, and if the poultry keeper does not wish to incur this extra expense he may follow the old method. In that event broody hens should be removed from the henhouses to places where they can sit quietly and be cared for apart from the flock. Where incubators are used the attendant must carefully study his machine, following closely the directions of the inventors or makers. In the use of brooders, the operator may rely more on his own judgment. So-called outdoor brooders are not satisfactory. The expense of brooder houses is small, when we take into consideration the number of seasons they can be used. These houses may also be used during the winter as colony houses for laying hens. (Farm Poultry, pp. 187–207; Progressive Poultry Culture, pp. 64–83; Profitable Stock Feeding, pp. 315–318; U. S. Dept. Agr., Farmers' Buls. 236; 357, pp. 6–13.)

130 Practicum. Take the class to a well-equipped poultry farm where may be seen modern poultry houses, brooders, incubators, and other appliances.

131 Recitation. Care of little chicks.

The shortest time to intervene between the hatching of little chicks and their first feed should be thirty-six hours. During the first

twenty-four hours they should have complete rest, either under the hen or in the incubator or brooder. After that, or even before, water and grit may be put down for them, the attendant giving the first food, whenever he thinks best, after the expiration of the thirty-six hours. Chickens hatched by hens may, as a rule, be fed sooner than those from the incubator, as the latter seem to require a little longer time for adjustment. It is found by experiment that chickens hatched by machines begin life with less mineral matter in their composition than chickens hatched in the nests of hens. By proper care and feeding this lack can usually be supplied, so that after a few weeks the fowls equal each other in vitality. It is important that in either case the chicks be fed sparingly at first, until the digestive apparatus is in working order. Whatever system of feeding is employed, the main thing is to supply the needs of the growing chick. It has to make bone, muscle, and feathers. For this purpose it will require more mineral matter and protein than starch and oils. Its grain ration should be supplemented with animal protein in some form. (Profitable Stock Feeding, p. 321; Farm Poultry, p. 209; Progressive Poultry Culture, p. 83; U. S. Dept. Agr., Farmers' Buls. 287, p. 31; 357, p. 13; Michigan Station Bul. 245; Indiana Station Buls. 71, 76; Ontario Department of Agriculture Bul. 151.)

132 Recitation. Feeding cockerels and pullets.

Whenever it is desired to dispose of the cockerels they should be separated from the pullets, and those not to be kept for breeding should be confined in crates, pens, or yards, and fattened for the market. The ration for them should now become "wider;" that is, only as much protein should be fed as will be necessary to keep them in good health and form. A mash consisting largely of corn meal, wet with skim milk, will cause the birds to take on flesh rapidly, and the flesh will be of superior quality. The narrow ration of the pullets should be continued, and they should be given increased range. The pullets should be given every advantage, for it is on their vigor and ability that we largely depend for winter egg production. (Progressive Poultry Culture, p. 87; U. S. Dept. Agr., Farmers' Buls. 287, pp. 34–38; 357, p. 19; Michigan Station Bul. 245; Pennsylvania Station Bul. 87; Utah Station Bul. 67, p. 140, Pls. III and IV.)

133 Recitation. Feeding laying hens.

Analysis of the egg shows it to be similar to milk in composition. The hen's ration must, therefore, consist largely of protein, but, in her case, it must be, in part, animal protein. This she secures for herself in summer, if given opportunity, but in winter her natural resources are cut off. During this season, too, the vegetable protein and succulence she procured so abundantly in pastures of bluegrass, clover, alfalfa, rape, etc., must be furnished. She will also require more

grain, for she is deprived of the seeds of many weeds and plants which her quick eye detects in summer. Any grain liked by fowls makes a good feed when properly balanced with vegetable and animal protein. If the poultry keeper has plenty of skim milk, it may not be necessary to feed other animal protein, especially if part of the milk is fed in the form of curd, the whey being rejected because of its bulk. Grit and oyster shell should be accessible at all times. Charcoal is also desirable, and granulated bone should be fed in hoppers whenever the ration seems deficient in mineral matter. Water, fresh and clean, should be before fowls at all times. (Profitable Stock Feeding, pp. 328–332, 336–343; Farm Poultry, pp. 158–173; Progressive Poultry Culture, 107; U. S. Dept. Agr., Farmers' Buls. 186, p. 23; 244, p. 25; 287, p. 19; 357, p. 31; New York Cornell Station Bul. 249; Pennsylvania State Station Bul. 87, p. 30.)

134 Recitation. Feeding ducks and geese.

In feeding ducks it must be remembered that there is no enlargement of the esophagus just below the throat to form the crop, as in chickens, turkeys, guineas, etc. Rapid growth can not be secured unless food is given in a condition to be easily digested and quickly assimilated. The best results are obtained by feeding wet mashes containing grit. The food of the wild duck contains much animal matter. Ducklings should receive animal protein to the extent of from 10 to 25 per cent of their daily ration. They are greedy feeders, and the work of preparing feed and carrying it to them, keeping troughs clean, etc., is considerable, but they make rapid gains and are soon ready for market. Ducks should be constantly supplied with water for drinking if they do not have access to ponds or streams. (Farm Poultry, pp. 245–250; U. S. Dept. Agr., Farmers' Bul. 64, pp. 32–36, 40–44; New York State Station Bul. 259.)

Geese, to be raised profitably, should be confined in a pasture which contains water. Land which is waste in an agricultural sense is useful for this purpose. A fence which will hold other farm animals is sufficient to confine geese. In such a pasture they will almost "keep themselves" in summer, and in winter the breeding stock should not be fed heavily. No expensive houses are required, a low shelter with a good roof and straw for bedding is all that is necessary. Geese are long lived and hardy. (Farm Poultry, pp. 257–260; U. S. Dept. Agr., Farmers' Buls. 64, pp. 38–48; 65, pp. 12–14.)

135 Practicum. Stock judging.

136 Recitation. Feeding turkeys and guineas.

The raising of turkeys has become the most difficult problem confronting the poultry keeper because of the disease called "blackhead," which devastates the flocks, both East and West. No cure has yet been discovered. Prevention, by breeding from strong stock, with

rational methods of raising the young, can do much toward stamping out the disease. Turkeys having plenty of range are much hardier than those in any degree of confinement, and are therefore less likely to contract disease. The same feeds are acceptable to turkeys that are relished by chickens. The danger from overfeeding is greater with poults than with chicks, and they are less able to withstand the ravages of lice and mites. (Profitable Stock Feeding, pp. 346–352; Farm Poultry, pp. 270–274; U. S. Dept. Agr., Farmers' Buls. 200; 334, p. 27; Rhode Island Station Buls. 123 and 124; Oregon Station Bul. 95.)

Little guineas should be fed soon after hatching, as nature has not provided so liberally for them beforehand as for chicks and poults. Their digestive organs are very small. For this reason they should be fed often, and but little at a time. They are exceedingly shy at first, but with careful handling will become very tame. (Profitable Stock Feeding, pp. 353–355; Farm Poultry, pp. 274–276; U. S. Dept. Agr., Farmers' Bul. 234.)

DAIRYING.

137 Recitation. Milk and its products. Secretion.

The raw material of the dairy industry is milk. Cow's milk is used almost exclusively, though in some districts of the old country goat's, ewe's, or mare's milk is used. Milk and cream are used for direct consumption, and for making ice cream, butter, cheese, condensed milk, and many other articles of food.

Have the pupils study the physiology of milk secretion—the internal structure of the cow's udder, how milk is secreted, the function of the blood as the source of raw material in the production of milk, how blood enters and leaves the udder. Consider also the milk veins, their importance as an indication of good milking qualities, the external appearance of the udder, well and badly shaped udders. (First Lesson in Dairying, pp. 1–10; Dairy Farming, pp. 130–131; (T) Milk and its Products, pp. 1–16, 253; Principles and Practice of Butter Making, pp. 22–28.)

138 Recitation. Composition of milk.

Milk is composed of water and solids, the solids consisting of fat, casein, albumin, sugar, and ash or mineral matters. The percentages of all these constituents vary, but an average composition, not exact, but easily remembered, may be given as follows: Water 87 per cent, solids 13 per cent. The solids include fat 4 per cent, casein 3 per cent, albumin 0.4 per cent, sugar 5 per cent, and ash 0.6 per cent. The fat of the milk is in globules. Their minuteness and varying size should be noted by the pupils. Butter fat is that portion of milk that goes to make butter; casein is the white substance that we see

in cottage cheese. In butter making the casein remains in the skim-milk and in the buttermilk, but it plays the most important part in cheese making. Milk sugar is similar to cane sugar, but not quite so sweet; it is the source of lactic acid, which makes the milk sour. Albumin and ash are of slight practical value. What is colostrum milk?

There is considerable variation in the quantity and quality of milk from different cows; some of these variations can be controlled by man, others can not be. In quality the fat percentage is mostly affected. The principal causes of variation in quality and quantity of milk should be discussed. They are as follows: (1) Individuality of cows, (2) breed, (3) feed, (4) age, (5) stage of lactation period, (6) manner of milking, (7) regularity and frequency of milking, (8) incomplete removal of milk, (9) whether first or last milk drawn, and (10) general environment. (Dairy Farming, pp. 124–134; (T) Principles and Practice of Butter Making, pp. 1–21, 65–76; Milk and its Products, pp. 10–15, 16–34; First Lessons in Dairying, pp. 11–13, 16–19.

139 Recitation. Testing milk.

By testing is meant the determination of the fat content in milk. Testing can be of great help to every dairyman, as by means of it he finds out which cows are profitable and which are not. Testing enables the creameries and cheese factories to pay for milk according to its quality; testing has made it possible to detect undue losses in butter and cheese making; it has to a great extent stopped the practice of watering and skimming milk, and has been of great service in dairy investigations. The Babcock method of testing milk for fat is the best and most accurate. The apparatus and chemicals used in the Babcock test are the centrifugal machine, glassware, and sulphuric acid, the latter to be used with great care. Consider the different makes of test bottles used for testing milk, cream, skim-milk, and buttermilk; show the principle of the Babcock test, how to make a Babcock test, and precautions necessary in making a test. Emphasize the fact that cream must be weighed, not measured. A sample of milk should be tested before the class and all manipulations connected with the testing explained. (Dairy Farming, pp. 135–145; First Lessons in Dairying, pp. 74–77; (T) Principles and Practice of Butter Making, pp. 84–93; Milk and its Products, pp. 35–65.)

140 Practicum. Testing milk and cream.

Have the pupils bring samples of milk from individual cows; emphasize the necessity of a fair sample and explain in advance how to take a sample. Try to secure samples of milk to prove what was said about the variation in the fat content. Have the pupils test all

the samples brought. The testing of milk should be repeated at any convenient time. (First Lessons in Dairying, p. 14.)

It would also be well to have the pupils bring samples of cream and test them. Test one sample of cream in two test bottles, one by measure and the other by weight. Call attention to the difference in results; explain again the reason for the difference; emphasize the fact that it is the practice in creameries in testing cream to weigh and not to measure the sample. (First Lessons in Dairying, p. 77; (T) Milk and Its Products, pp. 59–61; Principles and Practice of Butter Making, pp. 93–97.)

141 Recitation. Milking.

The importance of the milking process must be considered. It is necessary to treat the cows gently and kindly, because some of the milk is elaborated during the process of milking, and the secretion of milk in general is controlled by the nervous system. Note how the product is affected by regularity and frequency of milking, time between milkings, thoroughness in milking (the last milk is the richest), fast and slow milking. What is the difference between a good and a poor milker? Why the necessity of having good milkers, and what is the effect of changing milkers? The production of the cows and the work of the milkers as well may be influenced by regularly weighing and testing the milk of each cow. Emphasize again in this connection the importance of milk scales and the Babcock test.

Cows may be milked by hand or with the milking machine. What are the advantages and disadvantages of hand milking? The advantages and disadvantages of machine milking? What can be said regarding the efficiency of the milking machine? Study the construction of milking machines and the principle of their working; also the operating of the machine. Considering the cost of the machine and its equipment, the use of milking machines is economically practicable when the herd is large and where intelligent operators may be secured. (Dairy Farming, pp. 68–72, 201–202; The Farm Dairy, pp. 114–127; Milk and its Products, pp. 12–15.)

142 Recitation. Bacteria in relation to dairying.

What are bacteria? The best conditions for their growth? What is the importance of temperature? How may their growth be checked? Bacteria are the cause of changes taking place in milk and cream. What are the sources of bacteria in milk? There are different kinds of bacteria in milk—harmful, harmless, and useful bacteria. Have pupils learn about disease germs in milk; the souring of milk, or lactic fermentation; the change of milk sugar into lactic acid; the usefulness of lactic-acid bacteria; the part temperature plays in the process of milk souring; how to prevent milk from getting sour in too short a time; also other changes produced by bac-

teria, such as bitter milk and slimy or ropy milk. There are also gas-producing bacteria, poison-producing bacteria, and bacteria which produce coloring matter, as well as bacteria causing changes in the butter fat. (Dairy Farming, pp. 146–156; First Lessons in Dairying, pp. 33–36; Principles and Practice of Butter Making, pp. 44–53; Milk and its Products, pp. 66–82; U. S. Dept. Agr., Farmers' Buls. 348, 413.)

143 Recitation. The production of clean and sanitary milk.

The requirements for the production of clean and sanitary milk are (1) healthy and clean cows, (2) clean barns, (3) clean yards, (4) clean milkers, (5) clean milk vessels, (6) clean wholesome feed, (7) pure water, (8) clean strainers, (9) pure air in the stable, (10) clean bedding, (11) milking with dry hands, (12) cooling the milk after milking, and (13) a clean milk room. Point out the advantages of covered milk pails, the straining and cooling of milk, the necessity of cold water and ice, of a milk cooler, and of a milk room or milk house. (Dairy Farming, pp. 155–164; First Lessons in Dairying, pp. 61–73; U. S. Dept. Agr., Farmers' Buls. 227, pp. 24–28; 241, pp. 6–8; 273, pp. 23–30; 413.)

144 Recitation. Creaming.

What are the objects of creaming? There are two methods of creaming, the gravity method and the centrifugal method. Gravity creaming is done in shallow pans, in deep cans, and in dilution separators. Which of these three ways of gravity creaming gives the best and which the poorest results? What advantage has the centrifugal method over the gravity method as to completeness of creaming? What are the different makes of separators? The advantages of the farm separator over the factory are: (1) Less fat left in the skim milk, (2) fresher and cleaner cream, (3) fresher skim milk for calves, and (4) diminished cost of hauling to the depot or creamery.

Describe the process of separation; the efficiency of creaming with a separator. Not over 0.1 per cent of fat ought to be left in the skim milk. In the successful use of the separator the following are important: (1) The speed of separator, (2) steadiness in running, (3) temperature of milk, (4) amount of milk skimmed per hour, (5) acidity of milk, (6) richness of cream, (7) stage of lactation, and (8) "slush" in bowl. Have the pupils understand thoroughly the requirements for running a separator properly and ask them to make observations at home and to report how the separators are run.

How should we start and stop a separator? The cream screw is used to obtain cream of desired richness or thickness. Cream testing 30 to 40 per cent is the best for creameries because there is less cream to handle, less hauling, and rich cream keeps better. With the same

milk the cream test will vary because of the separator and the operator. The reasons for this lie in variation in the fat percentage of the milk, in the temperature of the milk, variation in the speed of the separator, in steadiness of the bowl, and in the amount of water or skim milk used to flush the bowl after separating. Cleaning the separator with hot water and washing powder after each creaming is necessary. Some difficulties in running a separator are: Hard running, leaking, and clogging. Give general suggestions as to mounting, oiling, and operating a separator. (Dairy Farming, pp. 165–170; First Lessons in Dairying, pp. 21–32; (T) Principles and Practice of Butter Making, pp. 123–148; Milk and its Products, pp. 97–126; The Farm Dairy, pp. 129–134; U. S. Dept. Agr., Farmers' Buls. 201; 241, pp. 16–18; 273, pp. 27–30.)

145 Practicum. Operating the farm separator.

Secure about 5 gallons of milk. Have the separator taken apart and put together by several pupils; explain and demonstrate its construction. Call attention to the cream screw and the possibility of changing the richness and amount of cream. Warm the milk up to the right temperature and run it through the separator. The cream and skim milk may be mixed and the milk separated again, but under different conditions. For example, note the effect of changing the cream screw and lowering the speed, etc. Test the cream as well as the skim milk and notice the variation in richness under different conditions; note also the variation in amount of cream. If not too inconvenient the separator should be used often. Demonstrate what has been talked over during the last recitation.

Have the pupils bring cream and especially skim-milk samples from home; have some brought from gravity creaming. Have all samples tested. The separator skim milk should not show more than 0.1 per cent fat. If there is more, it is probably the fault of the operator. Induce the pupils to locate the trouble. Compare the percentage of fat in the gravity and separator skim milk and call attention to the superior work of the separator.

146 Recitation. How to secure good cream for sale or for butter making.

The following important points should be emphasized: The necessity of producing clean milk, of having clean utensils—separator included; the necessity of cooling the cream after separating, of ice for cooling purposes, and of a clean, cool place where the cream can be kept until disposed of. A tank with ice water may be used for keeping the cream, but an ice box would be still better. Call attention to the cheap and efficient ice box described in a bulletin named below. The churning or delivery of cream should be done frequently enough to have no cream spoil. Deliver every day, or at least every

second day; churn at least twice a week. ((T) Principles and Practice of Butter Making, pp. 158–167; U. S. Dept. Agr., Farmers' Buls. 201, pp. 12–22; 237, pp. 25–26; 241, pp. 16–18; 353, pp. 29–31.)

147 Recitation. Butter making.

What is understood by cream ripening? The object of cream ripening is to produce flavor and aroma, to facilitate the separation of butter from buttermilk and increase the yield of butter, and to improve the keeping quality of butter. Could butter be made from sweet cream? Give attention to the changes taking place in the cream during ripening; to bacterial growth as the cause of these changes. What should be the temperature for ripening? What is a starter? What may be said of the use of sour cream, buttermilk, sour milk, whole milk, or skim milk as starters? What are the advantages and disadvantages of their use? What are commercial starters or pure cultures? Their use is confined largely to creameries, although they might be used on the farm to advantage. Consider the stirring of the cream during ripening; time of ripening; how to tell when cream is ripe enough; how to prevent overripening of cream; the best way of ripening cream where churning is done twice a week.

The different kinds of churns should be described. The barrel churn is the best for a farm dairy. Consider also the temperature at which cream ought to be churned and factors influencing the churning temperatures—the season of the year, the individuality of cows, the stage of lactation, kind of feed given to the cows, the richness of the cream, the degree of ripeness of the cream, the temperature of the room where churning is done, and the amount of cream in the churn. To secure the best results, the cream must be cooled to the right temperature two or three hours before churning. Consider the different ways of cooling the cream and the disadvantages and bad effects of too high or too low a churning temperature. A dairy thermometer is a very useful instrument. (Dairy Farming, pp. 170–180; First Lessons in Dairying, pp. 37–46; The Farm Dairy, p. 137; (T) Principles and Practice of Butter Making, pp. 187–237; (T) Milk and its Products, pp. 127–146; U. S. Dept. Agr., Farmers' Bul. 241, pp. 18–25.)

148 Recitation. Churning and working butter.

Discuss the preparation of the churn for churning; the straining of the cream while pouring it into the churn; the adding of butter color and the quantity to use; the temperature of the cream; the speed of the churn; and gases in the churn. The churning should be completed within from 30 to 45 minutes. Other points to consider are the disadvantages of too long or too short churning time; the fact that churning until it gathers into large lumps injures the quality and ap-

pearance of the butter and may give it too high a percentage of water or moisture; the drawing off of the buttermilk, and the use of a strainer for this purpose.

In describing the finishing of the product, discuss the washing of butter and its object; the washing is done in the churn, and should be repeated several times or until the wash water does not become milky. Emphasize the fact that only clean, pure, odorless, and tasteless water ought to be used. If the water is not perfectly pure it should be boiled and cooled again before using. Consider the temperature of the washing water; salting the butter; the object of it; the kind of salt to use; the amount of salt to use; mottled butter; how to avoid mottling the butter; working the butter and its purpose; apparatus used; how the working is done; packing of butter in large packages, tubs, boxes, or jars, and also in 1-pound prints; butter printers; the use of parchment paper; labeled wrappers. (Dairy Farming, pp. 180–185; First Lessons in Dairying, pp. 46–52; The Farm Dairy, pp. 138–147; (T) Principles and Practice of Dairying, pp. 238–250, 256–276; (T) Milk and its Products, pp. 150–159; U. S. Dept. Agr., Farmers' Bul. 241, pp. 25–29.)

149 Recitation. General suggestions in making and marketing butter.

It would be well to make suggestions concerning the causes of difficult churning; the foaming of the cream in the churn and how to prevent or overcome it; cleaning the churn, emphasizing the importance of keeping the churn and all other utensils clean and sweet; the use of ladles in working and handling butter. What is the composition of butter? A national regulation fixes 16 per cent as the maximum of water in butter.

In discussing the marketing of butter, call attention to the three different ways of selling dairy butter—direct to consumers, to storekeepers, and to commission houses. The first way is usually the most profitable, as storekeepers usually can not or for some reason do not care to pay according to quality, therefore prices are lower. Emphasize the fact that only a fine grade of butter will give satisfaction and bring the highest returns in the long run. Butter of poor quality is always a source of trouble and loss. Emphasize the great value of a neat and attractive package, also of the initials or monogram of the producer on the butter or on the outside wrapper; advantages and disadvantages of storing butter; the value of advertising. (Dairy Farming, pp. 185–194; First Lessons in Dairying, p. 52; The Farm Dairy, pp. 150–154; (T) Principles and Practice of Butter Making, pp. 243–247, 269–286; (T) Milk and its Products, pp. 147, 157–159; U. S. Dept. Agr., Farmers' Bul. 241, pp. 27–31.)

150 Practicum.

It would be a good plan at this point to visit some good dairies or creameries, if such can be easily reached. Have the pupils watch the making of butter, and call their attention to all the points on which emphasis was laid in the class room. On such an excursion the pupils would have the opportunity of seeing a variety of dairy machinery and utensils and of observing practical dairy methods.

151 Recitation. Grading and judging butter.

Consider the object of grading and judging butter; its educational features; scale of points for judging butter—flavor 45, body 25, color 15, salting 10, package 5; taking the sample; the butter trier; cause of flat, rancid, unclean, weedy, sour, cheesy, and stable flavors; faults of body, such as a greasy, tallowy, or sticky consistency, milky brine, etc.; faults of color—uneven, mottled, wavy, etc.; too much or not enough salt; the presence of grit; unattractive or unclean packages.

In this lesson it would also be well for the teacher to make a general review of all important steps in the production of milk, cream separating, butter making, and marketing of the product. The following important points ought to be especially emphasized: Careful feeding of cows; clean barns; clean cows; clean milk; careful creaming, so as to avoid all losses of butter fat; cooling of cream after separating; proper ripening of cream; the use of a good churn; the right churning temperature; the bad effects of overchurning; the use of good wash water; the use of a good butter worker; proper washing, salting, working, and packing; the necessity of a clean milk or dairy room; the necessity of ice in summer time; the most profitable way of selling the product; the importance of cleanliness everywhere; the necessity of higher quality of produce to secure best price; and the need of a thorough understanding of the business to insure success. (Dairy Farming, p. 204; First Lessons in Dairying, pp. 78–83; (T) Principles and Practice of Butter Making, pp. 287–297.)

152 Lecture. Cheese making on the farm.

Consider again the composition of milk and point out that practically all the fat and casein and small amounts of sugar and ash are utilized in making cheese, though some of the fat goes into the whey. The most important of the milk solids for cheese making is the casein. Cheese can also be made from skim milk. Describe briefly and in a general way the process of cheese making—warming the milk to about 90° F., adding some color and rennet (explaining what rennet is made from), the coagulation of the milk (which remains sweet), the cutting of the curd, cooking or heating, removal of the whey, putting the curd into molds, pressing the

cheese, salting, and curing. Note the different varieties of cheese—Cheddar, Swiss, Brick, Limburger, Camembert, Roquefort, Gouda, Edam, Cottage Cheese, etc. ((T) Milk and its Products, pp. 163–164, 176–180; see also pp. 119–228 for the names of different varieties of cheese.)

153 Recitation. The making of farm dairy cheese.

Show the impracticability under ordinary circumstances of making Cheddar cheese on the general farm. Farm dairy cheese could be regarded as Gouda, Brick Cheese, and Cottage Cheese. Describe Gouda cheese and the apparatus and utensils used in making it—vat, knives, molds, press; the process of making it, such as warming the milk to the right temperature, adding color and rennet, rennet tablets being the best; the way to use them; time of coagulation or curdling; cutting, heating, cooking, removing the whey, molding, pressing; a simple press; dressing the cheese, pressing again, salting the cheese in brine, curing the cheese; the curing room or cellars. Emphasize the fact that perfectly sweet, clean milk should be used, and a clean, cool, moist room must be provided for the curing room. The curing requires from eight to twelve weeks.

Cottage cheese is also called Schmierkäse, Dutch Cheese, and Pot Cheese. Since no thorough directions for making this kind of cheese are available in printed form the following directions may be dictated to the pupils:

Cottage Cheese, sometimes called Dutch Cheese or Schmierkäse, is made from skim milk, though a small amount of buttermilk may be added. To make the cheese, allow the skim milk to become sour and curdled, then heat it to from 90° to 100° F. for about thirty minutes. After reaching the desired temperature remove the vessel from the heat and leave the curd in the hot whey for about fifteen minutes. Next remove the whey by pouring the heated clabber into a cheese-cloth bag or on a draining rack (made of wire screen with cheese cloth spread over it) and allow to drain until no more whey appears. The higher the temperature to which clabber is heated or, at like temperatures, the longer the time of heating and the longer the curd remains in the hot whey, the harder and drier the cheese will be. By regulating the time and temperature it is always possible to produce cheese of the desired consistency. The yield is about 15 to 20 pounds from 100 pounds of skim milk, and the price is about 10 cents per pound. Before using or selling, the curd must be worked thoroughly and some salt and cream added. The amount of salt added depends upon the taste of the consumers, 2 ounces to each 10 pounds of cheese being a medium amount. Adding cream greatly improves the flavor of cottage cheese, and since under ordinary conditions a pound of medium rich cream, testing 25 to 30 per cent fat,

would never be worth more than 10 cents, there is no danger of losing money by adding cream to cottage cheese. One pound of cream to 10 pounds of cheese is a fair ratio. In a cool place cottage cheese will keep for several days. The softer the cheese the sooner it will spoil and sour. Always use good, clean skim milk. Do not let it become too sour, and control the work with a clock and thermometer. (Dairy Farming, pp. 187–192; U. S. Dept. Agr., Farmers' Bul. 166, pp. 5–8, 15–16.)

154 Recitation. Marketing milk and cream.

Some of the different methods of marketing to be considered are: Retailing milk; selling milk to creamery, cheese factory, or milk-condensing factory; cooperative creameries. The dairyman must find out which market would be the most profitable for him. What is meant by certified milk? What must be observed in shipping milk? Other points to be considered are: Marketing cream; shipping cream to a city, or sweet cream to a local creamery; shipping cream to a centralized creamery; holding the cream; care of cream on the farm; delivering the cream; frequency of delivery; different ways of shipping cream; handling cream through a store; direct shipping; the cream shipping station; cream grading. The best way of selling milk is by weight and percentage of fat, and not by weight alone or by the gallon; cream always ought to be sold by weight and the test. (Dairy Farming, pp. 194–196; First Lessons in Dairying, pp. 53–57; The Farm Dairy, pp. 154–164; U. S. Dept. Agr., Farmers' Bul. 201, pp. 14–23.)

155 Practicum.

Take the class to a good cheese factory, that they may become thoroughly familiar with the methods of manufacturing this product.

TEXT-BOOKS AND MANUALS.

The following books are referred to in the exercises on preceding pages. Those marked with an asterisk (*) are well adapted to the needs of high-school students, and might be purchased by them as text-books.

Elements of Agriculture, G. F. Warren (New York and London, 1909).

*Types and Breeds of Farm Animals, C. S. Plumb (Boston, New York, etc., 1906).

The Study of Breeds in America, T. Shaw (New York, 1901).

Variation of Animals and Plants under Domestication, C. R. Darwin (New York, 1868).

Gleanings from the Desert of Arabia, R. D. Upton (London, 1881).

Judging Live Stock, J. A. Craig (Ames, Iowa, 1901).

Domesticated Animals and Plants, E. Davenport (Boston, New York, etc., 1910).

The Origin and Influence of the Thoroughbred Horse, W. Ridgeway (Cambridge, 1905).

A Sketch of the Development of the Modern Horse, F. S. Cooley (Oldtown, Me., 1906).
The Horse, I. P. Roberts (New York, 1905).
Light Horses: Breeds and Management, W. C. A. Blew et al. (London, 1894).
The Great Horse, Sir Walter Gilbey (London, 1899).
The Horse Book, J. H. S. Johnstone (Chicago, 1907).
The Percheron Horse, C. Du Hays (Baltimore, 1886).
Farm Buildings, J. E. Wing (Chicago, 1907).
Horses, Asses, Zebras, Mules, and Mule Breeding, W. B. Tegetmeier and C. L. Sutherland (London, 1895).
A Monograph of the Genus Bos. The Natural History of Bulls, Bisons, and Buffaloes, G. Vasey (London, 1857).
Farm Live Stock of Great Britain, R. Wallace (Edinburgh, 1907).
The Wild White Cattle of Great Britain, J. Storer (London, 1879).
New Elementary Agriculture, Bessey, Bruner, Swezey (Lincoln, Nebr., 1903).
Shorthorn Cattle, A. H. Sanders (Chicago, 1900).
Sheep Farming in America, J. E. Wing (Chicago, 1907).
Swine, G. E. Day (Des Moines, Iowa, 1906).
Races of Domestic Poultry, E. Brown (London, 1906).
American Standard of Perfection as adopted by the American Poultry Association (1906).
*Farm Poultry, G. C. Watson (New York, 1901).
Progressive Poultry Culture, A. A. Brigham (Cedar Rapids, Iowa, 1908).
The Perfected Poultry of America, T. F. McGrew (Washington, D. C., 1907).
Pigeons and all about Them, F. M. Gilbert (Boston, 1898).
*Profitable Stock Feeding, H. R. Smith (Lincoln, Nebr., 1906).
Feeds and Feeding, W. A. Henry (Madison, Wis., 1898).
Beef Production, H. W. Mumford (Urbana, Ill., 1907).
Milk and its Products, H. H. Wing (New York, 1908).
*Dairy Farming, J. Michels (Clemson College, S. C., 1907).
First Lessons in Dairying, H. E. Van Norman (New York, 1908).
The Farm Dairy, H. B. Gurler (Chicago, 1908).
Principles and Practice of Butter Making, G. L. McKay and C. Larsen (New York, 1906).
Swine in America, F. D. Coburn (New York, 1909).
The Care of Animals, N. S. Mayo (New York, 1903).

APPARATUS FOR THE DAIRY LABORATORY.

1 six-bottle Babcock tester complete	$9.00
6 cream-test bottles	1.00
6 skim-milk bottles	3.00
1 Troemner single-bottle cream test scale	9.00
1 cream separator	$60.00 to 75.00
1 barrel churn, metal, small.	
1 lever butter worker	5.00
1 first-class butter printer	2.00
Several butter ladles.	